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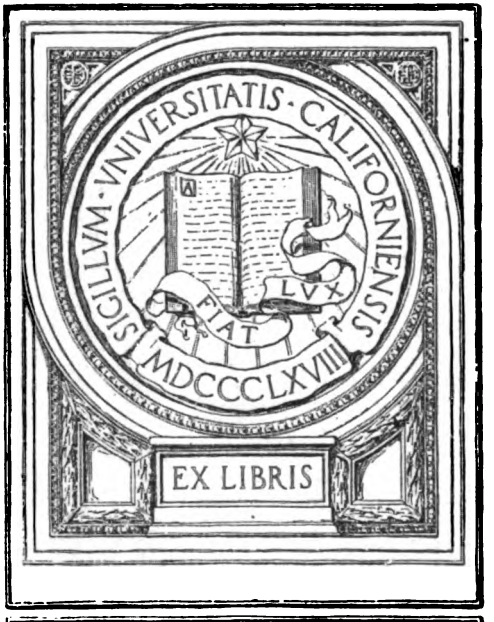

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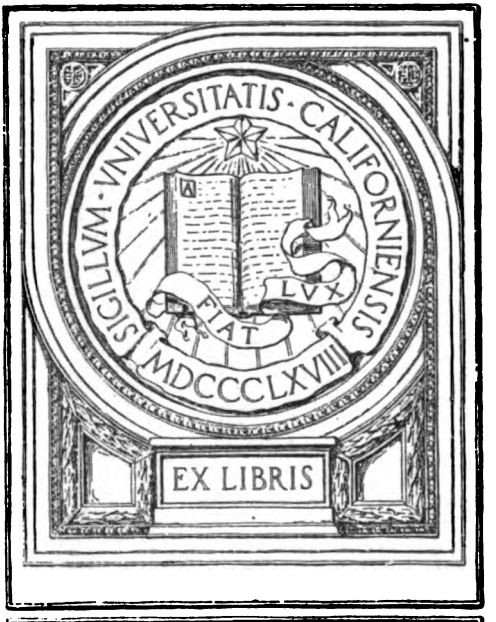

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TRANSACTIONS OF THE

SECTION ON

Obstetrics, Gynecology *and* Abdominal Surgery

of the
American Medical Association
at the Sixty-Fourth Annual
Session, held at Minneapolis,
Minn., June 17 to 20, 1913

AMERICAN MEDICAL ASSOCIATION PRESS
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LIST OF OFFICERS

The officers named below have served this Section. That division of practice included under the title of "Obstetrics and Gynecology" was formerly included with branches which now comprise separate sections. The names have been taken from the published records, which are deficient in some cases. It will be appreciated if any additional data are brought to the attention of the Secretary of the American Medical Association.

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Delegate, Thomas S. Cullen, Baltimore.

1913 Chairman, E. Gustav Zinke, Cincinnati.
Vice-Chairman, A. E. Benjamin, Minneapolis.
Secretary, Brooke M. Anspach, Philadelphia.
Delegate, R. R. Smith, Grand Rapids, Mich.

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PROCEEDINGS OF THE SECTION

TUESDAY, JUNE 17—AFTERNOON

The Section was called to order by the Chairman, Dr. F. F. Simpson, Pittsburgh, Pa.

Dr. E. E. Montgomery, Philadelphia, occupied the Chair during the reading of the Chairman's address on "Right Sided Hypertension with Occasional Cardiac Dilatation as Postoperative Complications."

Dr. George W. Crile, Cleveland, read a paper on "Some Newer Methods of Reducing the Mortality of Operations on the Pelvic Organs." Lantern-slides were shown in connection with the paper. Discussed by Drs. Henry O. Marcy, Boston; C. O. Thienhaus, Milwaukee, Wis.; A. E. Hertzler, Kansas City, Mo.; George Gellhorn, St. Louis, and George W. Crile, Cleveland.

Dr. Henry Dawson Furniss, New York, read a paper on "Postoperative Renal Infection." Discussed by Dr. J. W. Draper Maury, New York.

Dr. Richard R. Smith, Grand Rapids, Mich., read a paper on "Final Results of 193 Operations for Ectopic Pregnancy." Discussed by Drs. E. E. Montgomery, Philadelphia; Rufus B. Hall, Cincinnati; Chester M. Echols, Milwaukee, Wis.; John A. Lyons, Chicago; C. L. Hall, Kansas City, Mo.; John Osborn Polak, Brooklyn, and Richard R. Smith, Grand Rapids, Mich.

Dr. J. H. Carstens, Detroit, read a paper on "The Movable Kidney." Discussed by Drs. Rufus B. Hall, Cincinnati; Philemon E. Truesdale, Fall River, Mass.; Henry O. Marcy, Boston; A Goldspohn, Chicago, and J. H. Carstens, Detroit.

Dr. Edward Reynolds, Boston, read a paper on "Further Points on the Sterility of Women." Discussed by Drs. Robert T. Frank, New York; Laura Branson, Iowa City, Iowa; Charles S. Bacon, Chicago; J. H. Jacobson, Toledo, Ohio, and Edward Reynolds, Boston.

Dr. K. I. Sanes, Pittsburgh, Pa., read a paper on "Membranous Dysmenorrhea." Discussed by Drs. Robert T. Frank, New York; Henry O. Marcy, Boston; George Gellhorn, St. Louis, and K. I. Sanes, Pittsburgh, Pa.

WEDNESDAY, JUNE 18—MORNING

Dr. Franklin H. Martin, Chicago, read a paper on "Prolapse of the Uterus: Its Surgical Treatment."

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On motion it was resolved that the paper of Dr. Martin and the two succeeding papers be discussed jointly.

Dr. E. E. Montgomery, Philadelphia, read a paper on "Vagino-Uterine Prolapse and Its Effective Treatment."

Dr. George B. Somers, San Francisco, read a paper on "The Anatomy and Surgical Utility of the Sacro-Uterine Ligaments."

These three papers were discussed by Drs. A. E. Benjamin, Minneapolis; William M. Polk, New York; Walter B. Dorsett, St. Louis; J. Riddle Goffe, New York; Robert Earl, St. Paul; A. Goldspohn, Chicago; George Gellhorn, Chicago; G. Betton Massey, Philadelphia; Franklin H. Martin, Chicago; E. E. Montgomery, Philadelphia, and George B. Somers, San Francisco.

Dr. John Osborn Polak, Brooklyn, read a paper on "A study of the End-Results of the Webster-Baldy Operation." Discussed by Drs. Edward Reynolds, Boston; R. S. Yarros, Chicago; C. W. Barrett, Chicago, and John Osborn Polak, Brooklyn.

Dr. Philemon E. Truesdale, Fall River, Mass., read a paper on "Tuberculous Salpingitis." Discussed by Drs. D. C. Balfour, Rochester, Minn.; Curtis S. Foster, Pittsburgh, Pa.; J. H. Carstens, Detroit; John B. Murphy, Chicago, and Philemon E. Truesdale, Fall River, Mass.

Dr. John B. Murphy, Chicago, spoke on "Infections in the Pelvis from a General Surgeon's Point of View." Discussed by Drs. John B. Deaver, Philadelphia, E. Gustav Zinke, Cincinnati, and John B. Murphy, Chicago.

The Executive Committee was announced by the Chairman as follows: Drs. E. E. Montgomery, Philadelphia; Walter B. Dorsett, St. Louis, and C. S. Bacon, Chicago.

Wednesday, June 18—Afternoon

Dr. William J. Mayo, Rochester, Minn., read a paper on "Cancer of the Stomach." Discussed by Dr. William L. Rodman, Philadelphia; John B. Deaver, Philadelphia; John A. Lyons, Chicago, and William J. Mayo, Rochester, Minn.

Dr. Rufus B. Hall, Cincinnati, read a paper on "Cancer of the Uterus: Some Points to Be Emphasized in the Early Diagnosis." This paper was discussed with the two succeeding papers.

Dr. Emil Ries, Chicago, read a paper on "Theoretical and Practical Foundations of a Radical Operation for Carcinoma of the Cervix."

Dr. J. F. Percy, Galesburg, Ill., read a paper on "Heat in the Treatment of Inoperable Cancer of the Vagina and Uterus: Method and Results."

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These three papers were discussed by Drs. J. H. Carstens, Detroit; Walter B. Dorsett, St. Louis; C. W. Barrett, Chicago; G. Betton Massey, Philadelphia; William J. Mayo, Rochester, Minn.; John B. Deaver, Philadelphia; C. O. Thienhaus, Milwaukee, Wis.; John A. Lyons, Chicago; Bertha Van Hoosen, Chicago; Henry O. Marcy, Boston; Rufus B. Hall, Cincinnati, and J. F. Percy, Galesburg, Ill.

Dr. J. Shelton Horsley, Richmond, Va., read a paper on "Experimental Transplantation of Intestine After Resection of the Sigmoid, with Special Reference to Resection for Malignant Diseases of the Pelvis." Discussed by Drs. C. E. Ruth, Des Moines, Iowa; A. Goldspohn, Chicago, and J. Shelton Horsley, Richmond, Va.

THURSDAY, JUNE 19—MORNING

The following officers were nominated and elected: Chairman, Dr. E. Gustav Zinke, Cincinnati; Vice-Chairman, Dr. A. E. Benjamin, Minneapolis; Secretary, Dr. Brooke M. Anspach, Philadelphia; Delegate, Dr. R. R. Smith, Grand Rapids, Mich.; Alternate, Dr. John G. Clark, Philadelphia.

Dr. Joseph B. DeLee, Chicago, read the "Report of Committee on the Question: Should the Puerperal Uterus be Emptied of Ovular Remains in the Presence of Infection, and if so, When?" Discussed by Drs. E. E. Montgomery, Philadelphia; J. C. Litzenberg, Minneapolis; Robert T. Frank, New York; R. S. Yarros, Chicago, and Joseph B. DeLee, Chicago.

Dr. George Gellhorn, St. Louis, read a paper on "Local and Spinal Anesthesia in Gynecology and Obstetrics." Discussed by Dr. A. E. Hertzler, Kansas City, Mo.

Dr. W. Wayne Babcock, Philadelphia, spoke on "Spinal Anesthesia in Gynecology, Obstetrics and Abdominal Surgery." Discussed by Dr. Fred J. Taussig, St. Louis.

Dr. J. Riddle Goffe, New York, read a paper on "Biochemical Factors in the Causation of Uterine Hemorrhage."

Dr. John B. Deaver, Philadelphia, read a paper on "Treatment of Hemorrhage from the Non-Pregnant Uterus."

These two papers were discussed by Drs. Lewis S. McMurtry, Louisville, Ky.; J. L. Rothrock, St. Paul; J. Riddle Goffe, New York, and John B. Deaver, Philadelphia.

Dr. R. C. Coffey, Portland, Ore., read a paper on "Intra-Abdominal Adhesions." Discussed by Drs. J. H. Jacobson, Toledo, Ohio; John B. Deaver, Philadelphia; Rufus B. Hall, Cincinnati; C. E. Cantrell, Greenville, Tex.; Henry Boxer, Birmingham, Ala., and R. C. Coffey, Portland, Ore.

THURSDAY, JUNE 19—AFTERNOON

Dr. Fred L. Adair, Minneapolis, read a paper on "Care of the Umbilical Stump: A Bacteriologic Study." Discussed by Drs. Charles S. Bacon, Chicago; N. S. Heaney, Chicago, and Fred L. Adair, Minneapolis.

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Dr. Channing W. Barrett, Chicago, read a paper on "The Thyroid Gland and Its Degeneration in Relation to Obstetrics and Gynecology." Discussed by Drs. John N. Bell, Detroit; Mary M. Strong, Omaha, and Channing W. Barrett, Chicago.

Dr. Henry Schwarz, St. Louis, read a paper on "The Serodiagnosis of Pregnancy and Its Place in Practical Obstetrics." Discussed by Drs. Joseph B. DeLee, Chicago; J. R. Losee, New York; Chester M. Echols, Milwaukee, Wis.; N. S. Heaney, Chicago, and Henry Schwarz, St. Louis.

Dr. Charles S. Bacon, Chicago, read a paper on "The Essentials of Sanatorium Treatment of Tuberculous Gravidae and Puerperae and Their Children." Discussed by Drs. Walter J. Marcley, Minneapolis; Mary M. Strong, Omaha, and Charles S. Bacon, Chicago.

Dr. Alfred Baker Spalding, San Francisco, read a paper on "The Value of Abdominal Measurements in Pregnancy: A Statistical Study." Discussed by Drs. Frederick E. Leavitt, St. Paul; E. Gustav Zinke, Cincinnati, and Alfred Baker Spalding, San Francisco.

Dr. Simpson, the retiring Chairman, made a few remarks in appreciation of the cooperation of the members of the Section and in greeting to his successor, Dr. E. Gustav Zinke, to which Dr. Zinke replied.

On motion of Dr. Channing W. Barrett, Chicago, and Dr. Zinke a rising vote of thanks was given the retiring Chairman, Dr. Simpson, and the Secretary, Dr. Anspach, for their services in making the Section work so eminently successful in the present session.

Dr. Anspach moved a vote of thanks to the University of Minnesota and to the local Committee on Arrangements for all the help given in making the meeting successful.

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RIGHT-SIDED HYPERTENSION WITH OCCASIONAL CARDIAC DILATATION AS POSTOPERATIVE COMPLICATIONS *

F. F. SIMPSON, M.D.
PITTSBURGH, PA.

In earlier times it was customary for chairmen of medical meetings to give a review of the achievements of the year; but that was before the days of Franklin Martin, whose genius places a comprehensive review of the world's best surgical literature before us each month.

I cannot, however, refrain from referring briefly to three movements which show the trend of events. They indicate a wide-spread and urgent demand for standardizing surgical requirements, a systematic and cooperative effort for the common good of the people, and a definite recognition of America as a member of the family of surgical nations.

The formation of the College of Surgeons marks the beginning of a new era in American surgery. Its essential purpose is to encourage the development of sound surgical judgment, to render surgeons more skilful and to make surgery more safe. It is not to be an exclusive, but an inclusive organization. It hopes to number among its fellows every one who does safe, sound and honest work.

Thoughtful men everywhere have deplored the nihilistic views generally entertained regarding cancer. As an outgrowth of known facts and years of progressive thought, there has developed a movement which bids fair to yield humane results abundantly.

There was recently launched in New York an organization known as the American Society for the Control of

* Chairman's address.

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Cancer. This ambitious name was given in recognition of the fact that cancer is a curable disease, and with the belief that wide dissemination of a few simple facts will lead to early diagnosis and to actual surgical control of the disease. America is to be the field of its activity. It is to be truly American. Its directorate is to be made up of medical and other men of achievements from all parts of the country. It has good financial backing. The scope of its work does not contemplate conflict with the splendid efforts of other cancer organizations, but rather to supplement them by creating a public sentiment which will yield the support they need.

The personnel of the founders of this society is adequate guarantee that it will be ethical in all things. It has received the endorsement of interested constituents organizations forming the Congress of American Physicians and Surgeons. It bespeaks the good will of the various sections of the American Medical Association and the endorsement of the House of Delegates.

America formally takes her place among surgical nations. For the first time in our history an international surgical congress will meet in New York in 1914. Of greater interest to this Section is the fact that the Seventh International Congress on Obstetrics and Gynecology will meet in New York in 1915 under the leadership of a distinguished member of this section. Dr. J. Riddle Goffe of New York, the president of the congress, is cautiously developing plans, the fruition of which will do credit to American surgery.

SCIENTIFIC PAPERS

The literature and individual experiences abound with instances of acute dilatation of the heart in the course of and following such acute infectious diseases as pneumonia, diphtheria, etc.

Athletes are required to train for events entailing unusually severe exertion. That acute cardiac dilatation often occurs among those who enter Marathon races has been abundantly demonstrated by roentgenograms of

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the heart. Persons with weakened myocardium caused by the stress of excessive business or social cares, by marked anemia, or by the prolonged absorption of bacterial toxins, biliary poisons, etc., are warned to avoid sudden, excessive exertion. Transitory or fatal dilatation of the heart may readily occur when these very ordinary precautions are disregarded.

To perform surgical operations in the presence of such depressing agencies is to take serious risks which must be minimized in every way if even a reasonably safe outcome is to be expected.

To impose on such hearts the burden of a general anesthetic throughout a prolonged operation done with the patient in extreme Trendelenburg position, and later to give unnecessarily large intravenous injection of normal salt solution, would be to multiply these dangers instead of minimizing them.

Wertheim[1] has reviewed five hundred consecutive hysterectomies for uterine carcinoma. Of that series ninety-three patients died. All who died were subjected to necropsy. Even at necropsy acute dilation of the heart was found as the sole cause of death in twenty-two instances.

When one series of hysterectomies for cancer done at a world-famous clinic shows a death-rate of 4.4 per cent. from this one cause, I need present no further evidence to prove that it is a factor in postoperative mortality.

While I was visiting the Lakeside Hospital at Cleveland about five years ago, Crile was doing a direct transfusion of blood from husband to wife preparatory to a serious operation on the anemic woman. Crile called attention to the fact that it was very easy to dilate a heart if blood went across too quickly. Indeed, as he spoke, it occurred before our eyes. The face of the patient was slightly suffused, breathing became shallow and more frequent, the pulse quickly became accelerated

1. Wertheim: Die Erweiterte Abdominale Operation bei Carcinoma Colli Uteri.

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and the area of the right heart was increased as shown by percussion. The transfusion was temporarily stopped, the woman's head was elevated and her circulatory equilibrium was quickly restored. After a few minutes she was given more blood and then a successful operation was done.

The ease with which dilatation of the heart was produced, the absence of precordial distress, the slight change in the patient's condition and the readiness with which it was controlled, when recognized at its very inception, were a revelation. I had expected to see a picture of extreme gravity when cardiac dilatation was imminent. But here it had occurred, had presented no picture of extreme gravity, was promptly recognized and was promptly controlled.

This incident recalled to my mind a number of patients observed in my experience as an assistant and in my earlier individual work. The patients fell into two groups. In one group were those who were weakened by disease and had failed to rally after desperate operations. The pulse when they reached their beds was probably 130 and small; the patients were restless and seemed to have lost their courage. Instead of returning promptly to normal the pulse rate and quality grew progressively worse until a fatal termination was reached from twelve to thirty-six hours later.

In the other group this clinical picture developed suddenly, from eighteen to forty-eight hours after operation. It was thought at that time that the weakened circulation was probably due to a small volume of blood and to cerebral anemia. Following the practice of the times the foot of the bed was elevated and a liter or more of normal salt solution (with or without epinephrin) was given into a vein. We were puzzled and dismayed by a rapidly fatal termination in spite of what we were pleased to consider our beneficent efforts. Nor do I believe our experience was in any way unique.

In the light of Crile's work on transfusion it then seemed to me that our cases may have been instances of

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acute cardiac dilatation and that it would be worth while to apply his principles to our work. Each time the symptom-complex appeared thereafter, the patient's head was slightly elevated, fairly vigorous stimulation was begun and a competent internist was asked to examine the heart.

Our records in the period during which we have been looking for this affection shows fourteen cases in which grave circulatory disturbances and probably acute dilatation of the heart were then thought to have occurred. All the patients recovered.

A fairly extensive review of the literature shows a considerable number of excellent papers on acute cardiac dilatation during chloroform narcosis, in the course of and as a sequel to acute infectious diseases, after sudden overexertion, etc. Except the recent article by Gatch, Gann and Mann,[2] very little indeed has been said of this affection as a postoperative complication when ether is used.

Our conception of the clinical picture was therefore gradually formed. Indeed, it is not perfectly clear as yet. We have, however, formed the definite plan of looking with suspicion on patients whose myocardium may be presumed to have been weakened by hyperthyroidism, prolonged or very recent absorption of bacterial toxins (such as those of pneumococcus, streptococcus, diphtheria bacillus, etc.), of biliary poisons, of toxins from malignant neoplasms, by marked or prolonged anemia, etc. When after operation, particularly in these cases, we observe a rapid pulse that does not come promptly to normal, we look to the central circulatory system for the cause until other adequate explanation is found.

When the pulse, having fallen toward 100 after operation, shows an abrupt rise of twenty or more beats at any time during the succeeding two or three

2. Gatch, W. D., Gann, Dewell, and Mann, F. C.: The Danger and Prevention of Severe Cardiac Strain During Anesthesia, THE JOURNAL A. M. A., April 26, 1913, p. 1273.

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days, we expect to find one of the following causes for that disturbance: hemorrhage, atropin, right-sided hypertension, dilatation of the stomach or the rapid absorption of toxins surrounding a pelvic drain. This is usually precipitated by increased intrapelvic pressure following enema.

If to the rapid pulse is added a slight cyanosis, sudden decided weakness, decided apprehension, etc., with increased area of the right heart, the clinical picture is probably that of increased venous tension and should be treated as such.

With this picture in mind we have made a review of our last 2,100 consecutive abdominal sections, which shows that there were forty-nine deaths—a mortality of 2.33 per cent.

The records of the last two thousand abdominal operations are accessible. The findings in nineteen hundred of them follow. (The records of the last one hundred will be reviewed later on.)

1. Of the nineteen hundred cases the circulatory apparatus was perfectly normal in 1,661.

2. Evidence of some circulatory embarrassment occurred ninety-four times during anesthesia. Evidence connected in this conclusion is based on a drop in pulse-rate of forty or fifty beats within a short while after the patient reached her bed. In these cases the pulse remained perfectly normal after having dropped to that point. It is quite probable that in many instances the acceleration was caused by the use of atropin before operation (Figs. 25 and 26).

3. Some circulatory embarrassment occurred during anesthesia or within the first three days after operation 145 times. It was attributed to the central vascular system forty times; to hemorrhage six times (Figs. 5 and 6); to atropin five times (Figs. 8 and 9); to the absorption of toxins from drainage occlusion twenty-eight times (Fig. 10); to peritonitis twenty-two times (Figs. 11 and 12), and to acute dilatation of the stomach three times. In forty-one it was slight and transitory and the cause was not determined.

Circulatory embarrassment occurring during operation was attributed to right-sided hypertension or acute dilatation of the heart fourteen times (Figs. 14, 15, 16, 17 and 18).

Circulatory embarrassment occurring within the first three days after operation was attributed to excessive venous ten-

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sion in the great vessels or to cardiac dilatation twenty-eight times (Figs. 19, 20, 21 and 22).

It will be observed that the symptom-complex of circulatory embarrassment due to right-sided hypertension or to cardiac dilatation was observed only forty-two times, or in 2 per cent. of our abdominal operations.

As conclusions arrived at previous to Feb. 15, 1913, were based largely on clinical observations, it was determined to make parallel observations along the following lines:

1. A series of physiologic experiments on dogs, directed by Dr. Clyde Brooks of Pittsburgh.

2. A systematic study of the circulation with cardiac measurements before and after operation in a series of 115 patients subjected to abdominal operations, by Dr. H. G. Schleiter.

3. Systematic Roentgen-ray studies of the same series of patients based on pictures taken under like conditions before and after operation by Drs. Russell H. Boggs and Joseph Foster.

4. A continuation of the clinical work with an analysis of findings in the series of patients studied by Dr. Schleiter and by roentgenograms.

PHYSIOLOGIC MAMMALIAN EXPERIMENTS

In making these observations it has been the purpose to reproduce as far as possible conditions encountered in the daily work of the surgeon; that is, to employ, on the one hand, dogs with normal circulation, and on the other hand, dogs with weakened circulation caused by hyperthyroidism or by methods commonly employed in operating-rooms, or in the postoperative treatment of patients.

This is not intended as a criticism, but as a reminder that not only is the original disease a menace to the patient, but that the surgeon and his methods may constitute a positive menace to life. The recognition of this possibility naturally compels the surgeon to eliminate that menace as far as possible.

Methods

In these experiments only one type of disease was found in the dogs used, namely, hyperthyroidism,

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whereas, the surgeon is frequently confronted by such other affections as prolonged or severe anemia, absorption of bacterial poisons, particularly of streptococcus toxins, and prolonged absorption of biliary poisons, etc.

Observations were made on the arterial and venous blood-pressure of a series of dogs. The observations related to pressure under normal conditions, and pressure as modified by hyperthyroidism, by prolonged ether anesthesia, by changes in position, by the rapid intravenous injection of 0.9 per cent. sodium chlorid solution, and by ventricular fibrillation caused by interrupted induced electrical stimulation.

Technic

Dogs were completely anesthetized with ether and arranged so that manometric blood-pressure tracings from the right common cardiac artery and from the left external jugular vein might be taken. A mercury manometer was employed for the arterial tracings and a salt solution manometer containing a salt solution of 1,250 specific gravity was used for the venous tracings.

In all instances tracings were made with the dog in the horizontal position, in the Trendelenburg posture, and with a lowering of the caudal extremities (Fowler's position). These observations were repeated many times on each dog. In some instances it was thought advisable to inspect and palpate the heart directly. Accordingly in these cases the thorax and pericardium were opened and artificial respiration was maintained by a bellows.

In a number of instances salt solution was rapidly injected into the external jugular vein in order to embarrass the circulation by increased pressure on the right heart.

In one instance in which the heart was particularly strong and vigorous the ventricles were thrown into fibrillation by an interrupted induced electric current.

Results

1. *On the vigorous young dog with normal circulatory apparatus.*

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In all instances change of position caused a very slight and transitory change in arterial and in venous pressure.

When the animal was placed in marked Trendelenburg position there was a momentary rise in arterial and later a rise in venous pressure. When the caudal extremity was lowered there was a momentary slight decrease in arterial pressure and later a slight fall in venous pressure (Fig. 1). When 0.9 per cent. sodium chlorid solution was repeatedly injected through the external jugular vein, there was a sudden great increase in venous pressure followed by a rise in arterial pressure with a synchronous increase in amplitude of heart-beat recorded on the tracing. In other words, the normal vigorous heart responds to the stimulus of increased burden by efficiently performing the added work, and in connection with the normal vasomotor mechanism by quickly reestablishing and maintaining circulatory equilibrium.

These observations are in accord with those of Crile, which directed our attention to this subject.

2. *On the dog with weakened circulatory apparatus.*

Conversely, we here observed that when the circulatory mechanism of the dog is weakened by any of the causes mentioned before, instead of responding to the stimulus of increased work, it is overwhelmed and shows evidence of embarrassment.

This series of experiments includes those dogs with circulatory apparatus weakened by hyperthyroidism, by prolonged ether anesthesia, by extreme Trendelenburg position, and by intravenous injections of 0.9 per cent. sodium chlorid solution.

Our experiments on all of these dogs weakened by the foregoing conditions yielded essentially the same results.

Having taken the normal tracings for the dog in the horizontal position we then raised it to extreme Trendelenburg position. There followed a decided increase in arterial and venous pressure (Fig. 2). The pressure did not return completely or quickly to the normal level for the horizontal position. The weaker the dogs were the slower and less complete was the return.

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Having been kept in the extreme Trendelenburg position for a time, they were then replaced in the horizontal position, whereupon the venous and arterial pressure returned and remained normal (Fig. 1). Next the caudal extremity of the dog was lowered (Fowler's position). There followed a corresponding diminution in arterial and venous pressure.

In some experiments the thorax and the pericardium were opened for the purpose of examining the heart by direct inspection and palpation. It was found that when the dogs were in the extreme Trendelenburg position there was a decided increase in the venous tension with a corresponding slight dilatation of the right auricle and great veins. Next the dog was lowered to the horizontal position and later the caudal extremity was lowered to the Fowler position. There resulted a reduction in venous tension and tension of the right auricle corresponding to the tracings in the same positions previously obtained.

The next step was to further embarrass the heart by rapid intravenous injections of considerable quantity of normal salt solution into the external jugular vein. It was found that there was a marked increase in tension in the great veins and right auricle with some dilatation of the veins and auricle followed by increased dilatation of the right auricle, dilatation of the right ventricle and still later by dilatation of the left auricle and ventricle. After the saline injection was discontinued the heart was in fair condition, this added volume of salt solution was quickly distributed into the vascular tree and the circulation returned to its normal equilibrium. On the other hand, if the heart was in poor condition there followed arhythmia, lowered arterial pressure and other evidences of a failing circulation. In one instance, that of a vigorous dog with normal heart which was kept for a long time in Trendelenburg position without causing any embarrassment of the circulation, the thorax and pericardium were opened, the heart was exposed and the

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ventricles were thrown into fibrillation by induced electric current. Immediately the auricles and great veins became dilated and the circulation promptly failed.

It was observed that the dogs having large thyroids and suffering from hyperthyroidism yielded more quickly and more profoundly than other dogs to the depressive influences of posture, ether and intravenous injections of normal salt solution, etc.

It appears to be reasonable to consider the weakened circulatory apparatus of the dog, comparable to that of the weakened circulatory apparatus of the patient suffering from the following conditions: prolonged, profound anemia, hyperthyroidism or absorption of bacterial or biliary poisons, etc.

OBSERVATIONS ON THE CARDIOVASCULAR SYSTEM OF ONE HUNDRED FIFTEEN PATIENTS SUBJECTED TO ABDOMINAL OPERATION

In view of the small percentage of instances in which serious central circulatory embarrassment occurred in the series of 2,100 abdominal operations, it seemed quite possible that our present series of one hundred might fail to show a single instance. On the other hand, it was thought that at any rate some suggestive observations might be made. As a matter of fact, with one possible exception, there was no instance of cardiac dilatation to report in this series of observations.

One hundred and fifteen cases were studied to observe the change undergone by the cardiovascular system as a result of major abdominal operations under ether, cocain, novococain or a combination of these anesthetics.

The uniform method applied in all cases was to obtain the following data:

1. A brief history as to the occurrence of scarlet fever, diphtheria, throat infections, pneumonia, typhoid and rheumatic fever.

2. A history as to any previous cardiac condition. This save for occasional palpitation was negative in every case.

3. An examination of the blood-vessel walls.

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4. Record of the rate, rhythm and quality and character of the radial pulse before and after operation.

5. The blood-pressure, systolic and diastolic, pulse-pressure and venous pressure before and after operation (in sixty-four of the series).

6. The dimensions of the heart to the right and left of the midline at the base of the third interspace before and after operation, determined by percussion and auscultatory percussion. It was not attempted to locate the apex, as this is too uncertain in female patients.

7. The character of the heart sounds.

Sixteen patients had suffered from scarlet fever in childhood—five gave a record of rheumatic fever, four of pneumonia, ten of diphtheria, fourteen of typhoid fever and ten of tonsillitis, usually in recurring attacks.

Vascular thickening was observed six times out of twenty-seven patients over 40 and three times in seventy-three patients 40 years old or less.

Murmurs were noted five times before operation and in one case it appeared after operation, but remained for only a short time. It is of particular interest to note that in only one of the five preoperative cases was there a history of rheumatic fever; in another the patient had suffered from scarlet fever, typhoid and pneumococcus infections. None of the cases showing murmurs before operation showed any signs of disturbance referable to the cardiovascular system after operation, though two of the patients were very delicate, one being very feeble, before operation. In both instances the operation was practically completed under local anesthesia, not more than 1½ ounces of ether being used for either operation.

Arhythmias. Auricular fibrillation was not observed either before or after operation.

Sinus arhythmia occurred twice, once before operation and persisting afterward, and once after operation for twenty-four hours.

Extra systoles of ventricular origin were observed once before operation. They disappeared after operation and did not recur.

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Pulsus alternans was seen once before operation in a feeble patient of 60, with enlarged heart and chronic nephritis, but disappeared afterward.

While a number of hearts (nineteen) showed a slight increase in transverse measurement after operation, this increase even in those cases in which the pulse was considerably accelerated was so small as really not to count (from ⅛ to ¼ inch), it being readily conceivable that a very slight change in the position of the fleximeter finger could produce such an alteration. Also a slight increase in measurement of the same sort was observable when the pulse had not undergone any acceleration.

In the greatest number of cases (fifty-nine) no change in outline was noted, notwithstanding that in a number of these the pulse reached 120 and above.

In a few cases there was an apparent diminution in the heart's outline in association with a rapid pulse, that is, a change in the border, especially the right, of as much as ½ inch. Yet in all these cases the acceleration appeared due to causes residing elsewhere than in the cardiovascular system.

The study of the cardiovascular system in 115 consecutive abdominal operations failed to show any case of marked right-sided hypertension. In two instances, however, the circulation showed embarrassment consistent with an increase in venous tension, or the early stages of the condition under consideraton.

One patent who showed considerable cyanosis with rapid pulse and sudden weakness on the table, though showing nothing noteworthy in her percussion outlines, gave evidence in a roentgenogram of a slight diminution in the heart's transverse diameter, coincident with an increase in diameter of the great veins at their point of entry into the right auricle. There was noted also a systolic murmur at the left of the sternum lasting not more than twenty-four hours. The cause of this murmur was not determined, though it seems possible that it might have been due to a temporary change in the tri-

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cuspid ring caused by venous and right auricular dilatation (Figs. 29 and 30).

Another case with a rapid pulse twenty-four hours after operation, from 140 to 160, though giving no evidence of change in the heart's outline, showed at this period an increase of venous pressure as shown by the sluggish emptying of the vein at the hand, which had to be lifted 12 inches above the level of the heart before the vein flattened. The roentgenogram of this patient showed the transverse vascular measurement to be increased 4 mm., while the heart measurements were unchanged. Here the picture seems typical of a slight transitory increase in pressure in the right auricle and venae cavae, without, however, going to the stage of dilatation (Figs. 27 and 28).

As to changes in arterial blood-pressure, it would be difficult to draw definite conclusions, aside from the fact that increase or decrease of systolic and diastolic pressure did occur owing to the disturbance of equilibrium in the circulation. By comparing the variations in pressure with cardiac measurements of the same patients, however, it was noted that when the cardiac measurements were normal or increased there was a more frequent and more marked drop in postoperative blood-pressure that when the heart measurements were smaller.

In certain cases the systolic pressure rose; in others, about an equal number, it fell; it is noteworthy that in a large number of cases, about 50 per cent., the pulse-pressure remained the same regardless of rise or fall of systolic pressure.

ROENTGENOGRAPHIC FINDINGS

From the series of 115 consecutive abdominal sections, one roentgenogram was made before operation and one or two after operation in seventy-five instances. The other forty were dropped from the list for some definite reason, as two exposures on the same plate, failure to obtain the preoperative picture, such postoperative

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change of position as would prevent securing pictures that could be compared with those obtained before operation, etc.

These pictures were not studied until the entire series was completed. The series of pictures of each patient was illuminated and careful measurements were made with calipers and ruler, first in the vascular area between the arch of the aorta and the heart, and, secondly, the broadest part of the heart.

The preoperative measurements were considered as normal for each patient. Some of the postoperative measurements were normal, others showed a fractional increase and others a fractional decrease. In strict conformity with the clinical course and clinical measurements none showed a marked increase in the size of the cardiac or vascular areas. Among others, the two cases mentioned before showed a moderate increase in vascular measurements. A careful analysis of roentgenographic measurements, however, is very suggestive (Table 1).

TABLE 1.—COMPARATIVE MEASUREMENTS OF PREOPERATIVE AND POSTOPERATIVE ROENTGENOGRAMS

Area.	Result.	Times Observed
Vascular	Increased	58
Cardiac	Increased	32
Vascular	Normal	22
Cardiac	Normal	23
Vascular	Diminished	10
Cardiac	Diminished	35

These measurements are consistent with the view that the dilatation begins in the great veins.

In this comparative table there are five duplicates in the vascular measurements and fifteen in the cardiac measurements. The duplicates occur because of a variation in measurements made on pictures taken the day of operation and those taken the next day or the second day after operation.

Maximum cardiac measurements were more often observed on pictures taken the second or third day after

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operation. Thus, of the thirty-two times in which the heart measurements were increased after operation, two postoperative pictures were taken twenty-six times. Of these the second picture (that is, the one taken from forty-five to seventy-five hours after operation) showed maximum measurements seventeen times, whereas in the first picture taken the day of operation maximum measurements were found only five times. In four instances the measurements were unchanged.

When the postoperative cardiac measurements were smaller than normal, the maximum reduction was noted the day of the operation nineteen times, the day after operations seven times, and in two instances the measurements were unchanged. In seven instances only one postoperative picture was taken, making the total of thirty-five in which a cardiac reduction was noted.

An analysis of measurements shows that with few exceptions variations were slight. Thus in the fifty-eight instances in which there was an increase of vascular measurements the increase was 6 mm. or less in forty-four cases, and 7 mm. or over in nine. In only four instances were the measurements increased 1 mm. or more. None of the decreased vascular measurements exceeded 7 mm.

TABLE 2.—INCREASE AND DECREASE IN VASCULAR AND CARDIAC DISEASES

Increased.				Decreased.			
Vascular Area.		Cardiac Area.		Vascular Area.		Cardiac Area.	
mm.	No. Cases.	mm.	No. Cases.	mm.	No. Cases.	mm.	No. Cases.
1	1	1	1	1	1	1	2
2	5	2	4	2	1	2	2
3	10	3	3	3	1	3	1
4	10	4	5	4	2	4	4
5	11	5	4	6	0	5	6
6	7	6	4	6	3	6	1
7	2	7	1	7	1	7	1
8	3	8	2	..	..	8	7
9	0	9	1	..	..	9	0
10	1	10	2	..	..	10	2
11	2	16	1	..	..	12	1
12	1	22	1	..	..	14	3
..	..	..	..	..	..	15	2
..	..	..	..	..	..	16	1
..	..	..	..	..	..	17	1

Of the increased cardiac measurements eighteen were 6 mm. or less, while four were as follows: two, 10 mm.,

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NOTE

The charts which follow have been reduced to one-third of their original size.

Explanation of Charts

Temperature is in black ink. Respiration is in red ink. Dots (.) in all charts represent time of making record.

Urine.—

V—Voided. Albumen in red ink.

C—Catheterized. Casts in black ink.

Character of material vomited is indicated as follows:

C.—Clear.

B.—Bile.

F.—Feces.

H.—Blood.

Under Peristalsis.

⊕—Aided by enteroclysis.

E—A & G enema.

G—Glyc. enema.

X—Unaided.

B—Bowel movement.

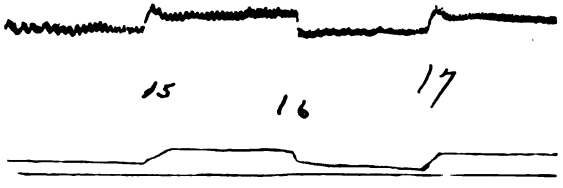

Fig. 1.—Arterial and venous tracings from a fairly normal dog. At "15," the dog was put into the Trendelenburg position with prompt rise and readjustment of arterial pressure and more gradual rise of venous pressure. At "16," horizontal position resumed; at "17," Trendelenburg position. No cardiac failure.

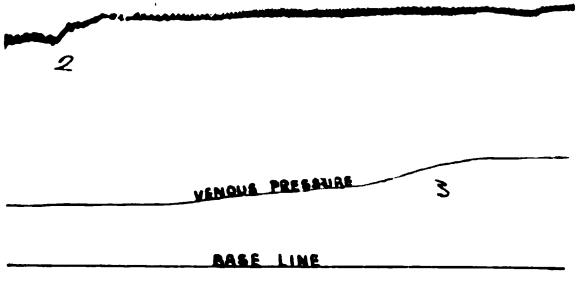

Fig. 2.—Fairly normal dog placed in Trendelenburg position with prompt rise of arterial and progressive rise of venous pressure. No cardiac failure.

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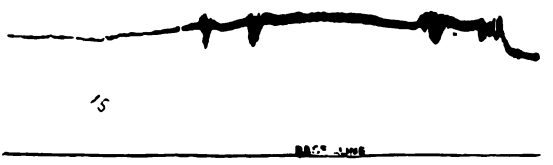

Fig. 3.—Dog weakened by prolonged anesthesia. Trendelenburg position, and finally by rapid intravenous injection of normal salt solution. Embarrassment of circulation is shown by arhythmia, increasing amplitude of pulse-beat and finally by fall of pressure.

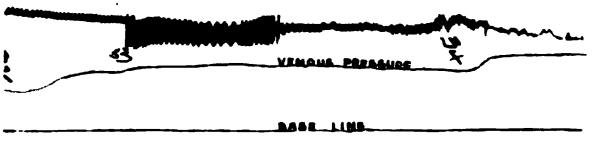

Fig. 4.—Dog weakened by prolonged anesthesia, prolonged Trendelenburg position, and a large quantity of salt solution given intravenously. Embarrassment of circulation is shown by arhythmia, increased amplitude of pulse-beat, rise of venous pressure and gradual fall of arterial pressure.

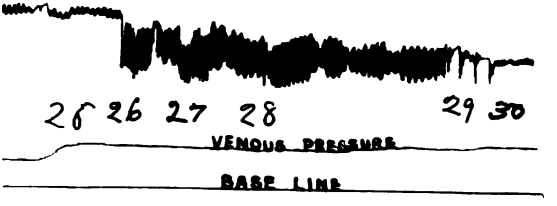

Fig. 5.—Dog weakened by prolonged anesthesia, prolonged Trendelenburg position, and by a large quantity of salt solution given intravenously. Embarrassment of circulation is shown by marked arhythmia, increased amplitude of pulse-beat, rise of venous pressure and fall of arterial pressure.

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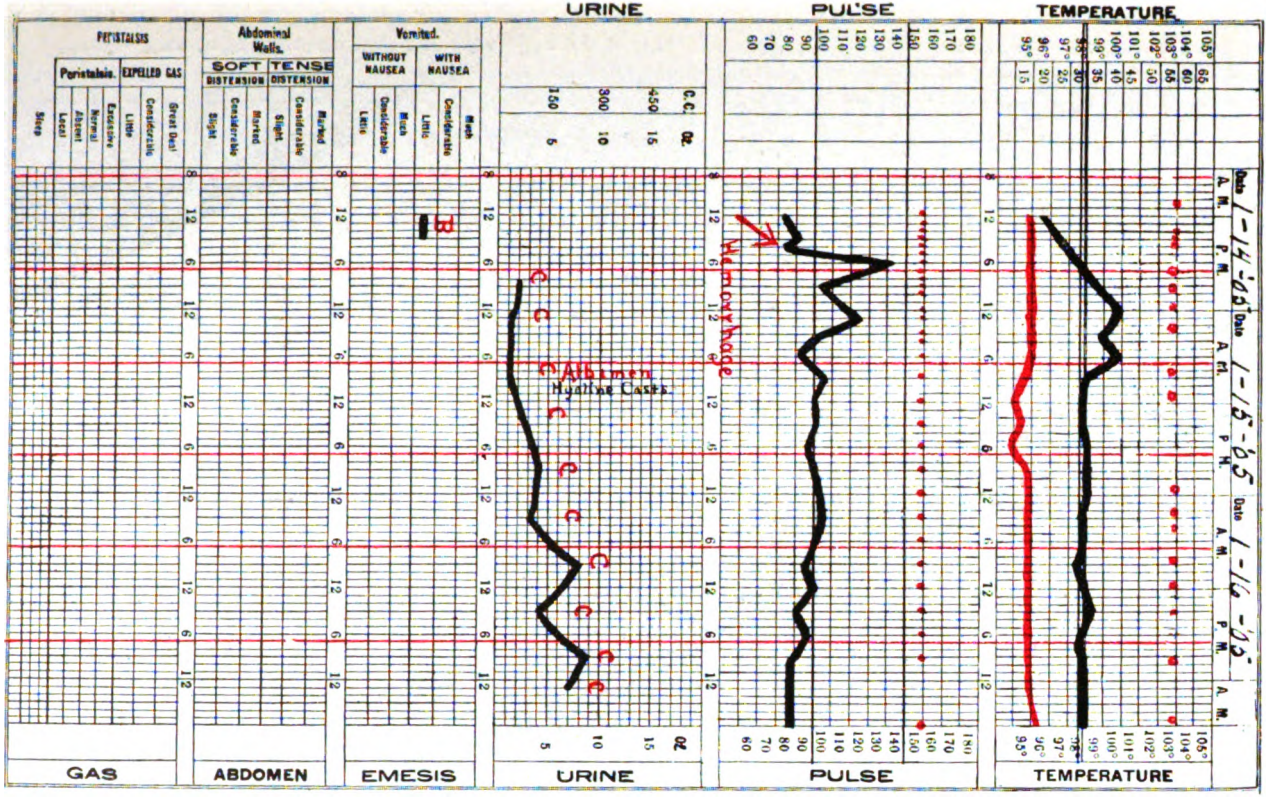

Fig. 6.—"Steeple pulse" of hemorrhage. Recovery. Consecutive hemorrhage usually occurs within the first eight hours after injured vessels are disturbed and causes an abrupt rise in pulse-rate. If a pint or less of blood is lost, the circulatory equilibrium is quickly reestablished and the pulse falls quickly toward normal.

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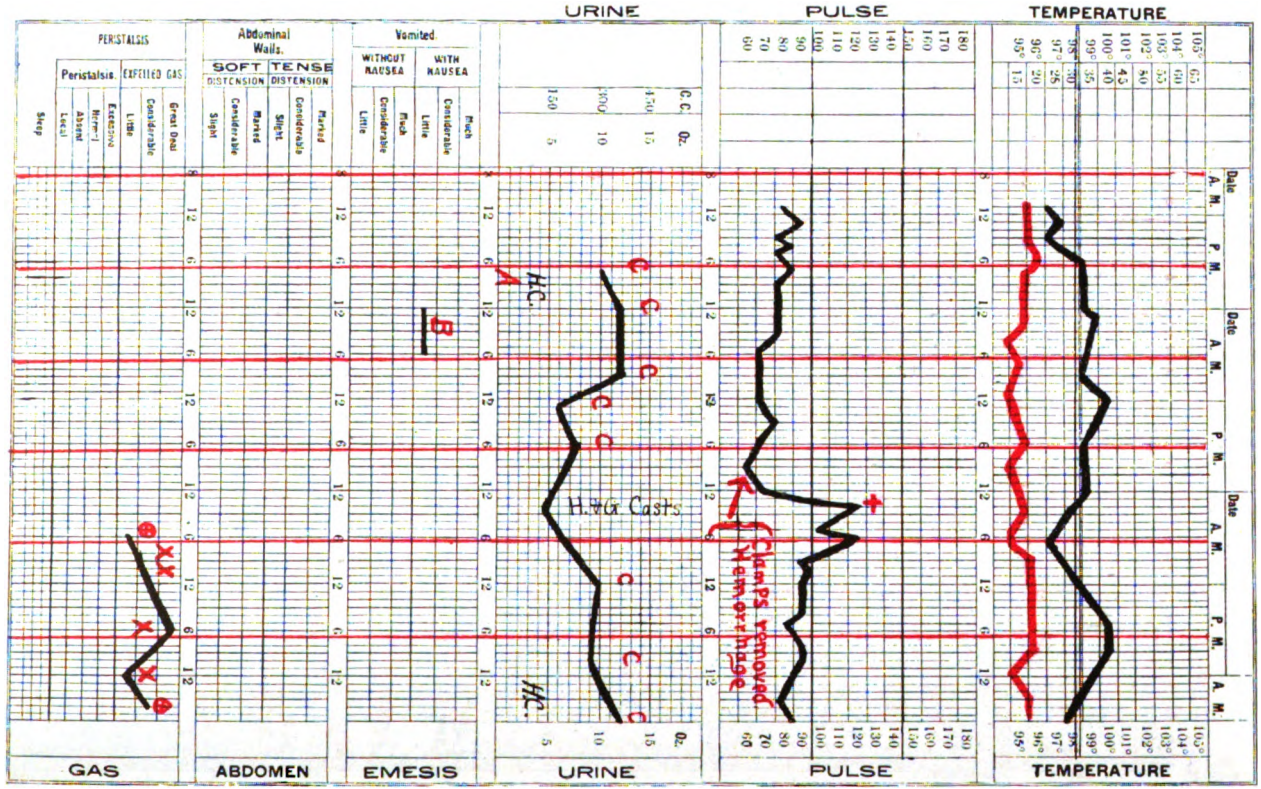

Fig. 7.—Here vaginal hysterectomy was done. The clamps were removed thirty-seven hours after operation; the cut vessels disturbed and bleeding occurred. Recovery.

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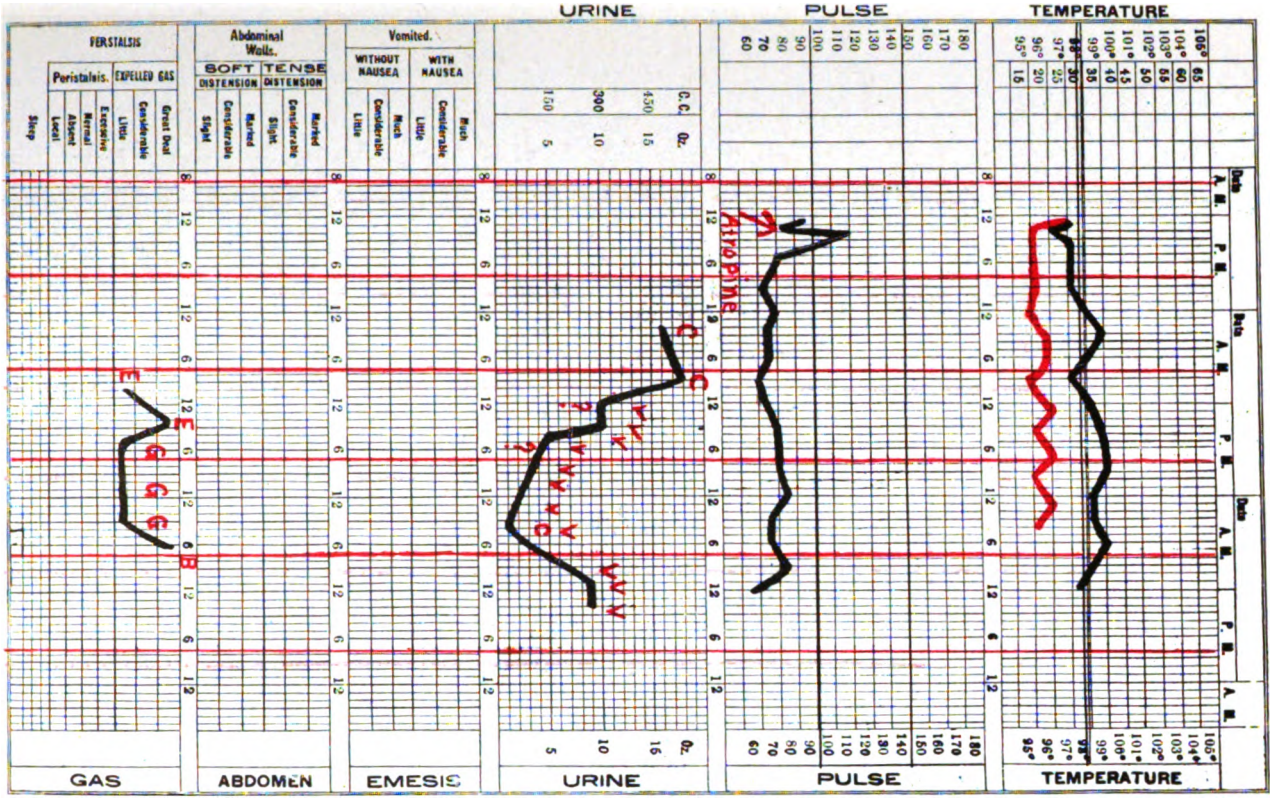

Fig. 8.—"Atropin pulse" is strikingly like that of hemorrhage. The two may readily be confused unless one recalls their similarity.

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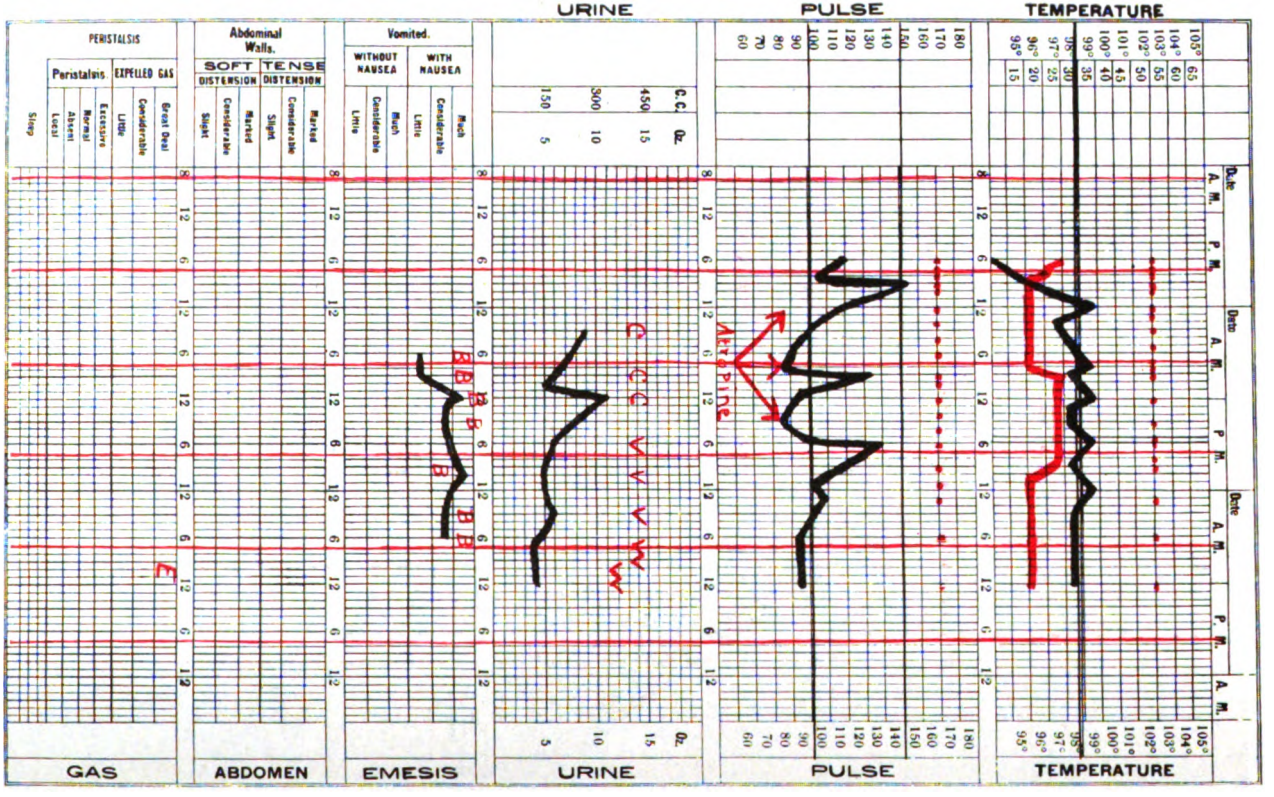

Fig. 9.—"Atropin pulse." Three doses of atropin. Three abrupt rises in pulse-rate.

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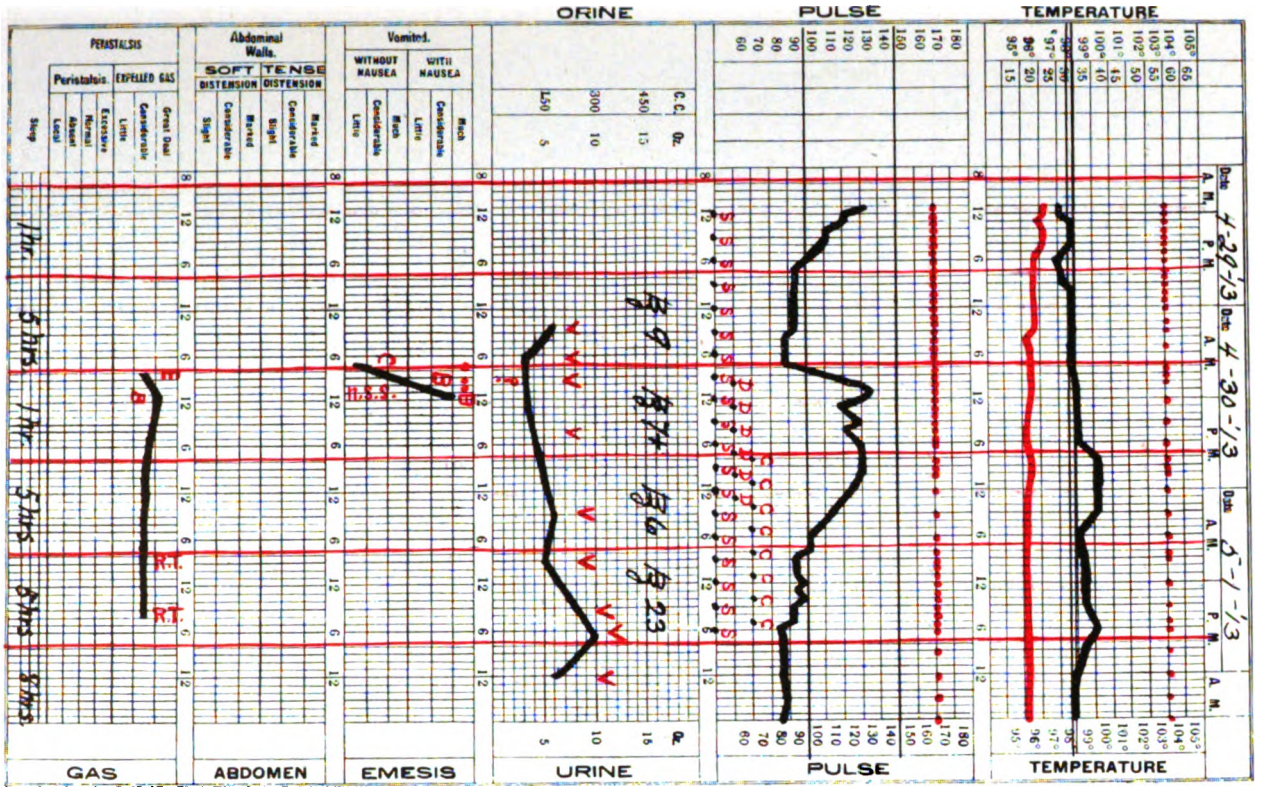

Fig. 10.—Absorptions of toxins from drainage occlusion. Recovery. It occasionally happens that a pelvic drain is inserted and that rapid absorption of toxins is precipitated by increased intrapelvic pressure following and incident to an enema.

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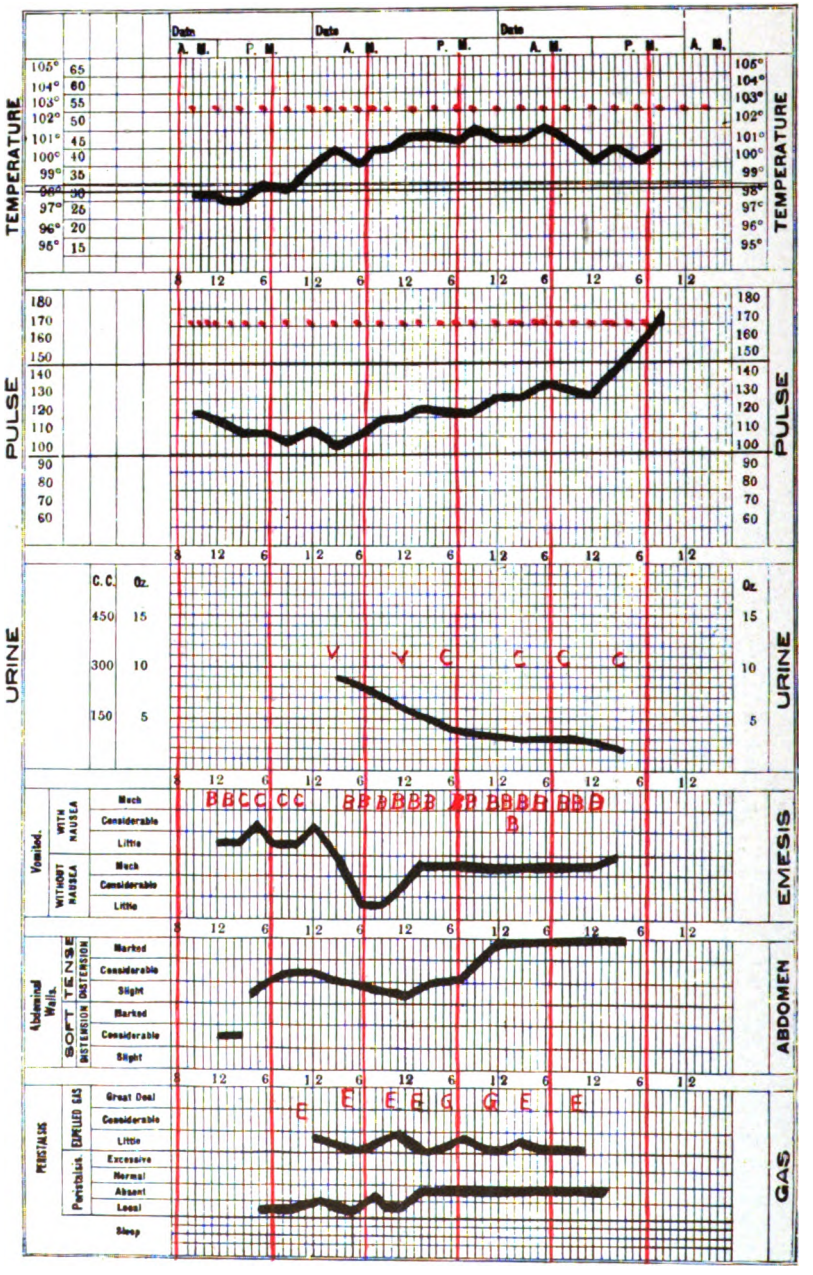

Fig. 11.—Fatal peritonitis. Pulse-curve, etc.

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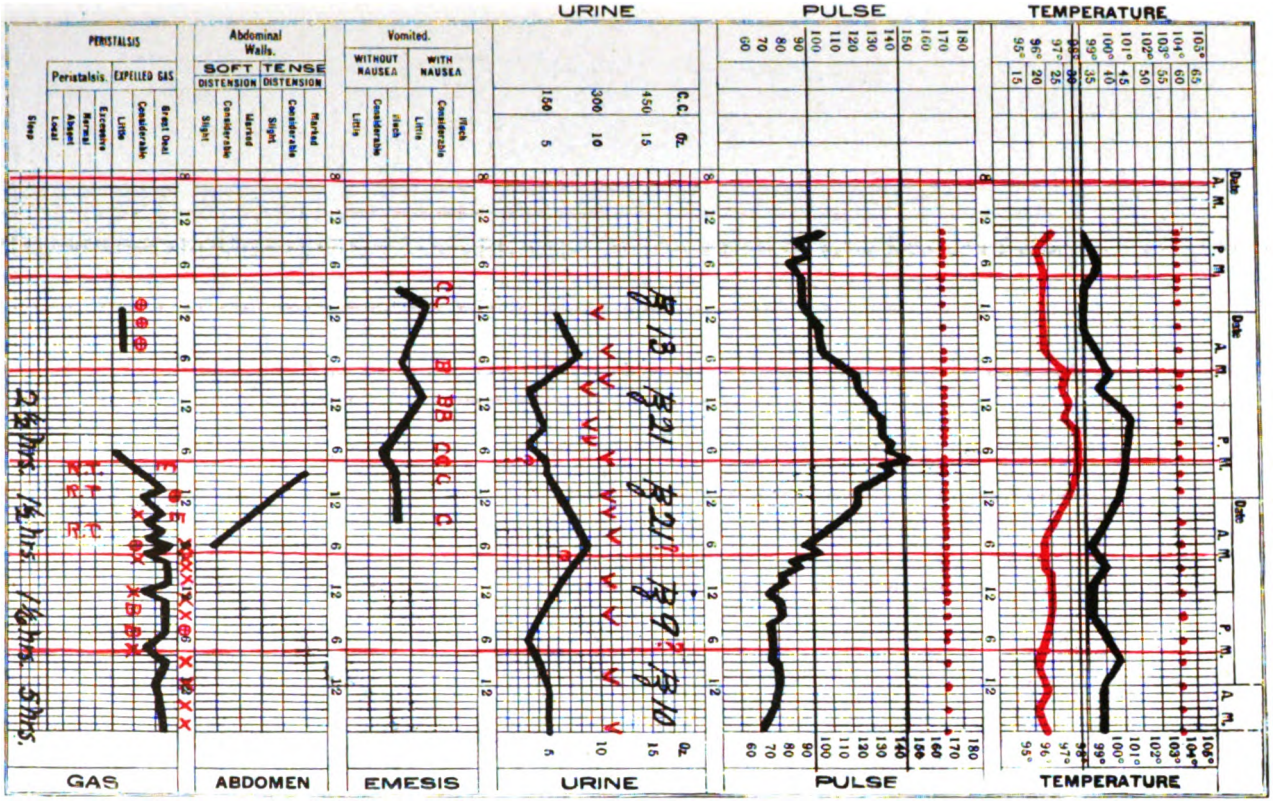

Fig. 12.— Peritonitis. Recovery. When postoperative peritonitis is detected at its beginning it may usually be treated successfully by Fowler's position, ice-caps applied to the abdomen, cardiac stimulants, washing the stomach frequently, etc.

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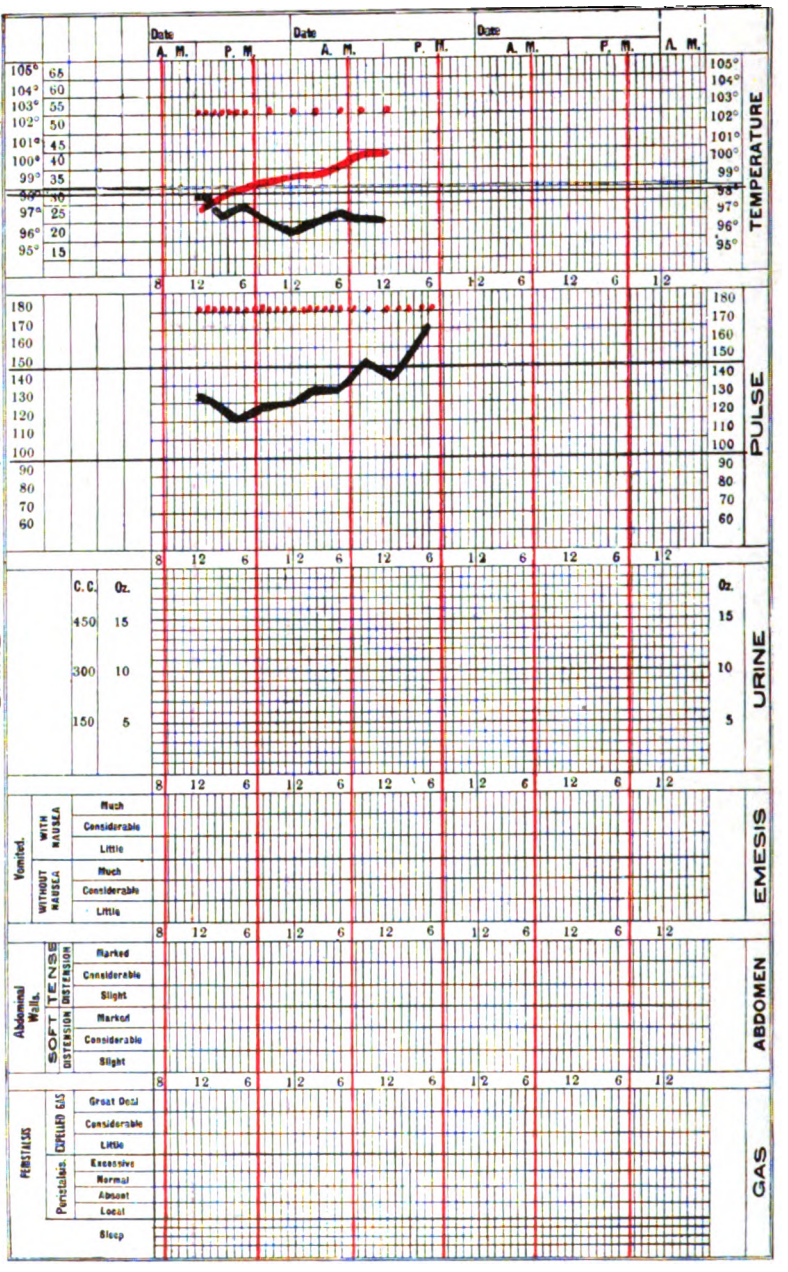

Fig. 13.—Diagrammatic pulse-curve of fatal cardiac dilatation beginning during operation.

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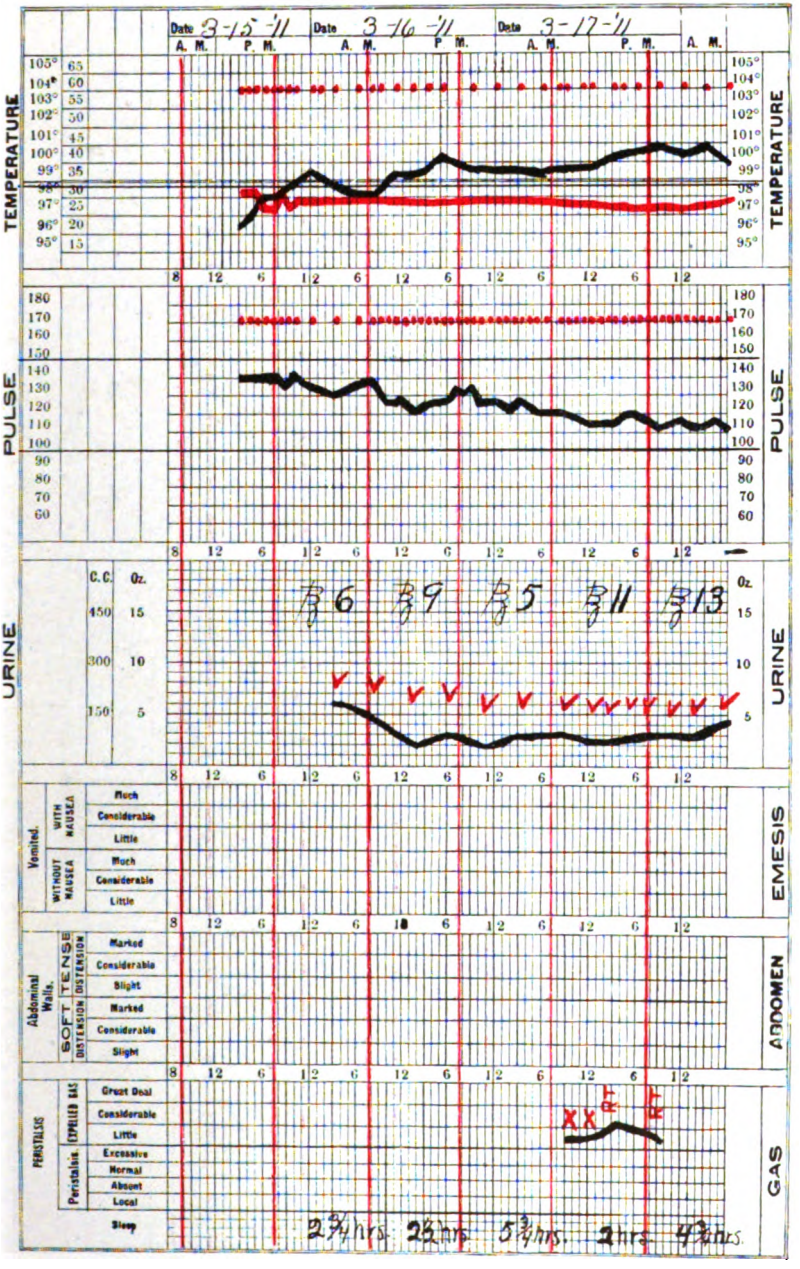

Fig. 14.—Dilatation occurred during operation. Gradual return of pulse to normal. There had been prolonged preoperative streptococcus and nelsserian poisoning.

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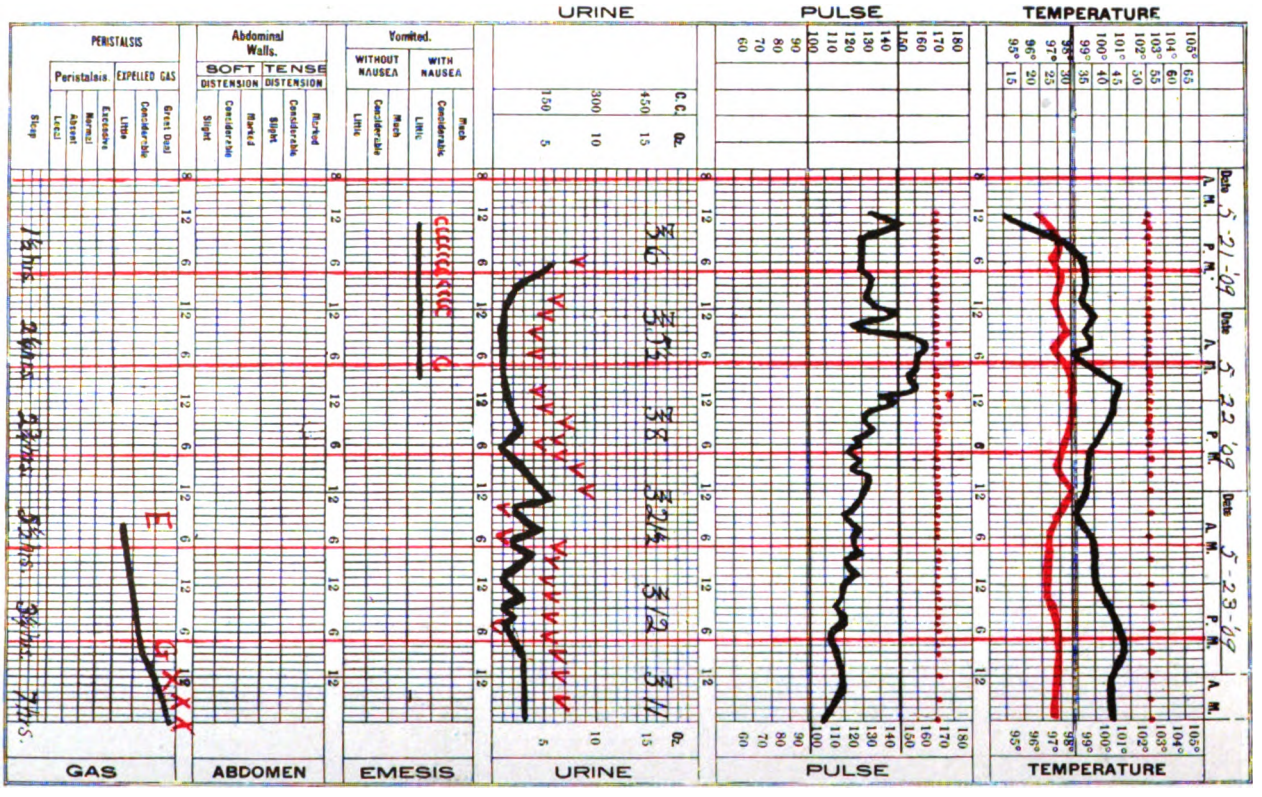

Fig. 15.—Marked venous hypertension occurred during operation and again fourteen hours later, with gradual return to normal. There had been prolonged preoperative streptococcus and neisserian poisoning.

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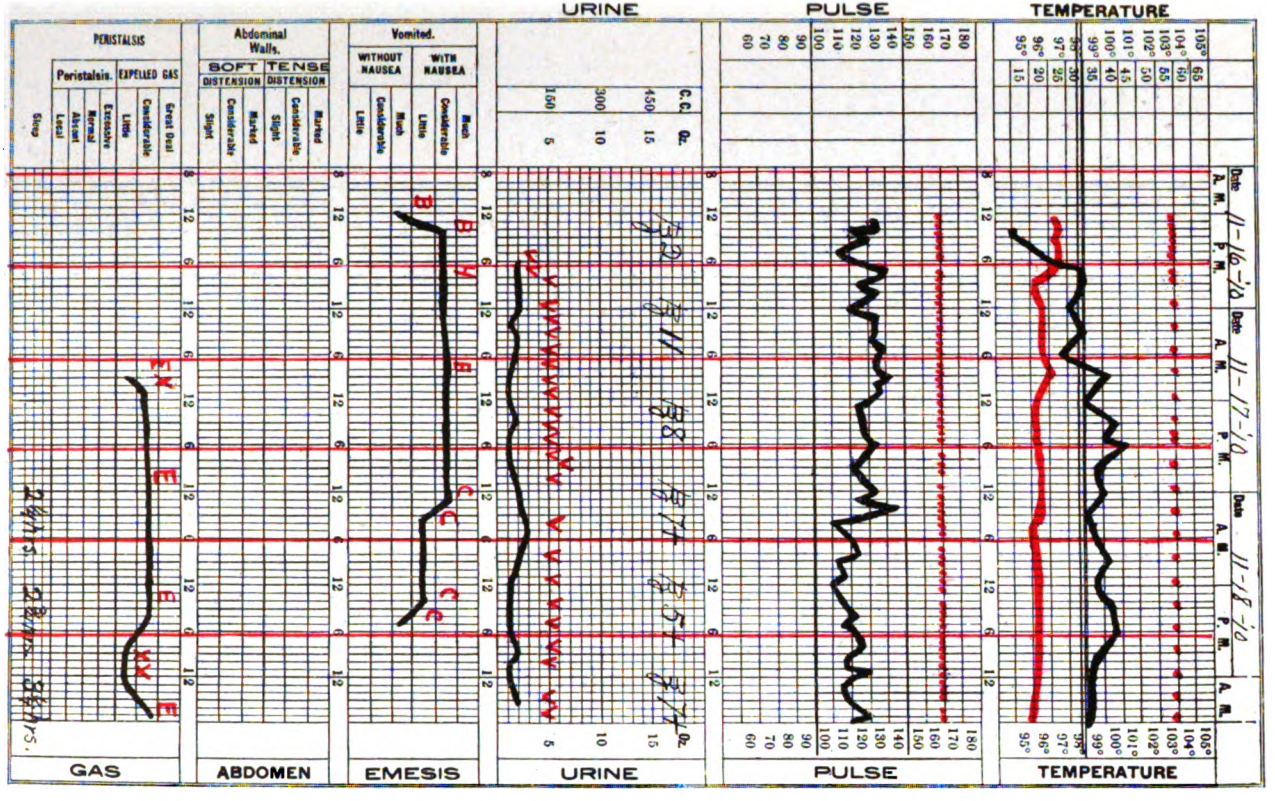

Fig. 16.—Right auricular dilatation occurred during operation. Gradual return to normal. There had been prolonged preoperative streptococcus and neisserian poisoning.

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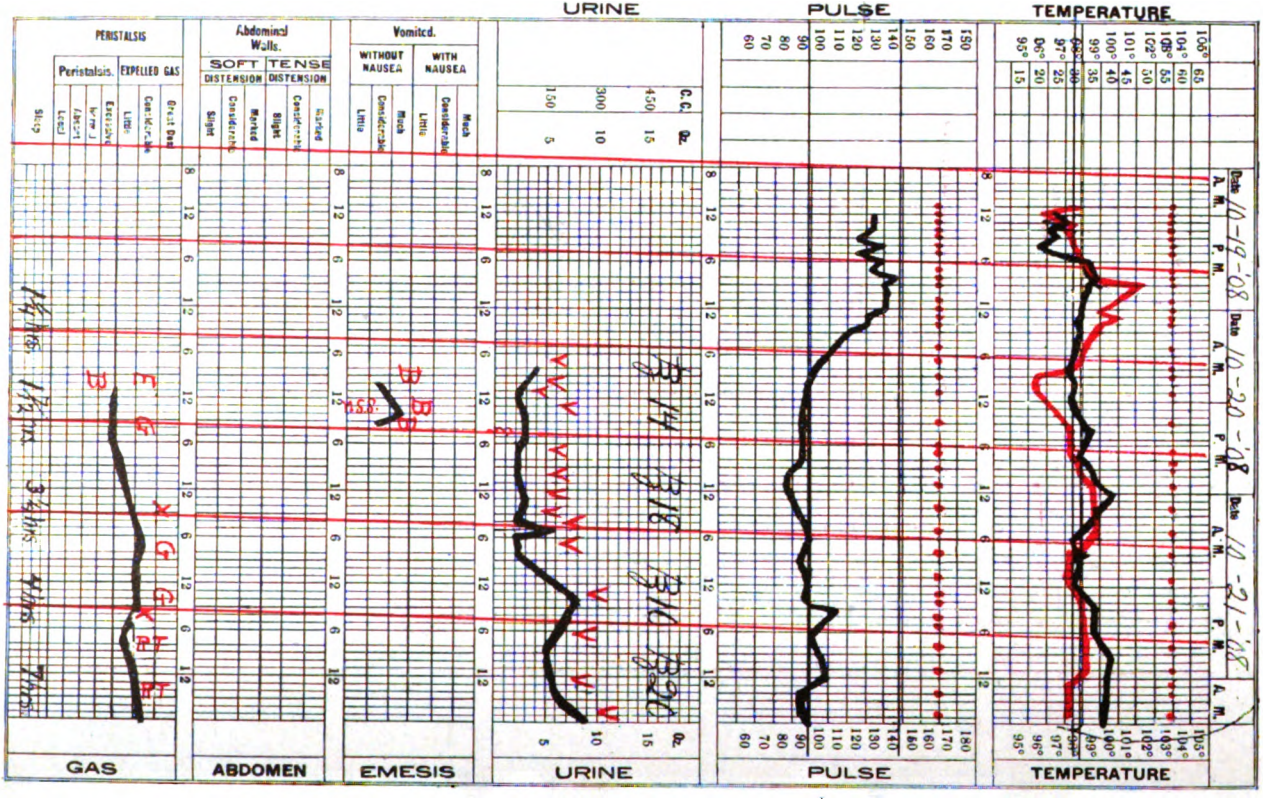

Fig. 17.—Preexisting loud musical murmurs, diffuse apex-beat and compensatory hypertrophy. Dilatation. Edema of lungs. Prompt response to cardiac stimulants.

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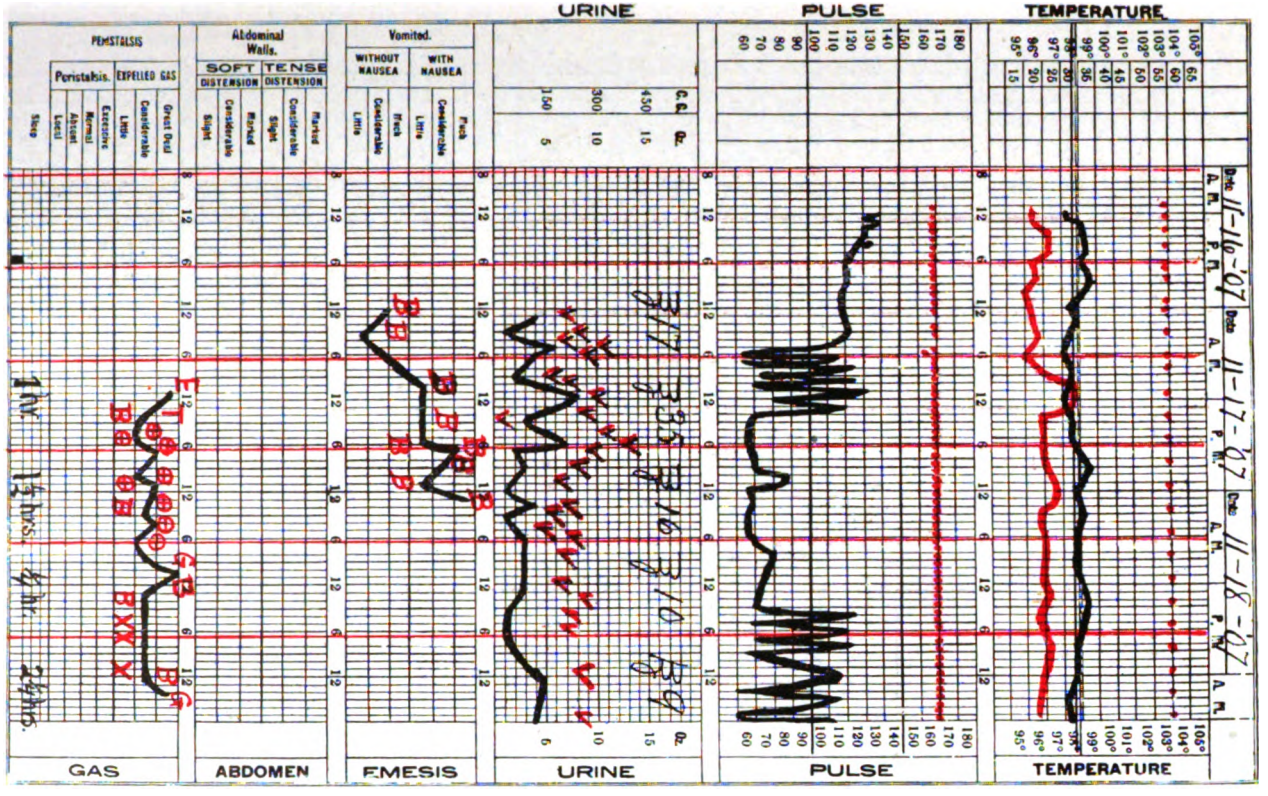

Fig. 18.—Cardiac dilatation. Digitalis poisoning. Large ovarian cyst. Weak heart. Orthopnea. Marked edema of extremities. Operation done with local anesthesia. Infusion of digitalis given by bowel for several days before operation.

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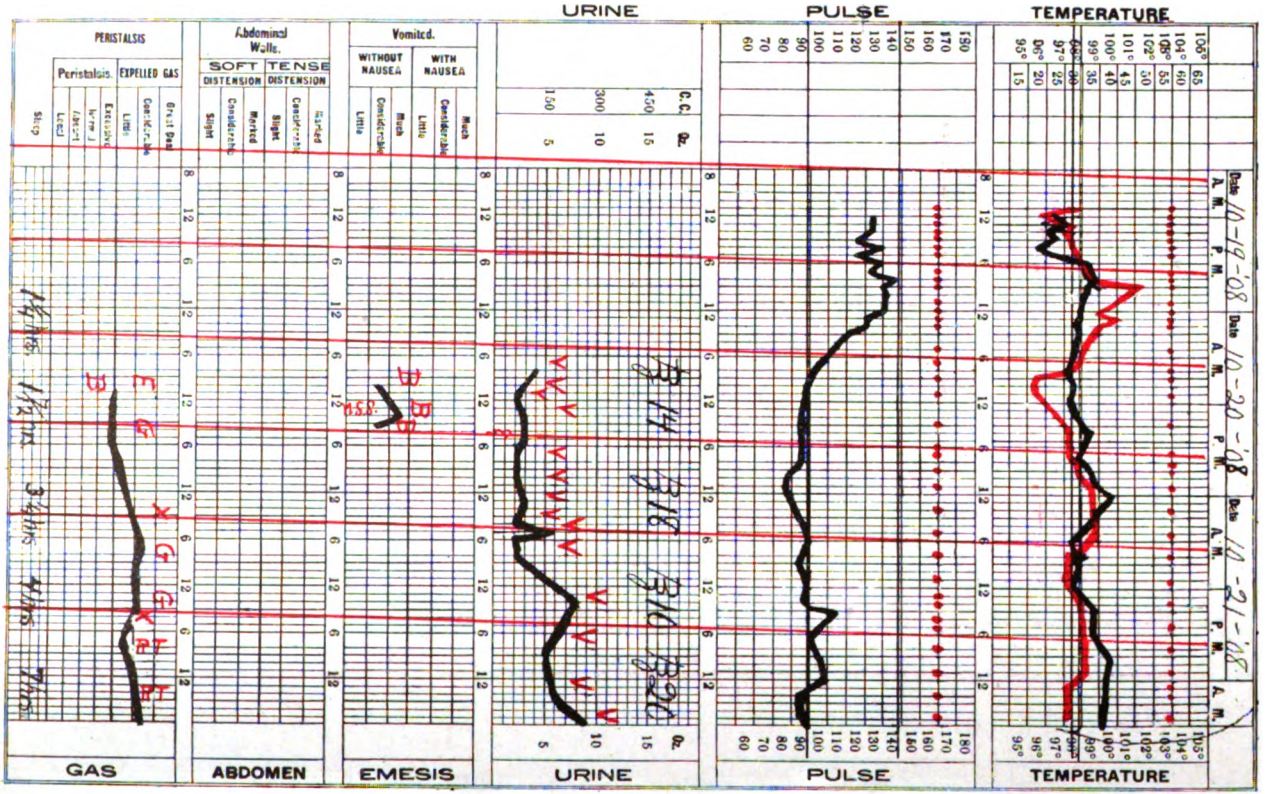

Fig. 17.—Preexisting loud musical murmurs, diffuse apex-beat and compensatory hypertrophy. Dilatation. Edema of lungs. Prompt response to cardiac stimulants.

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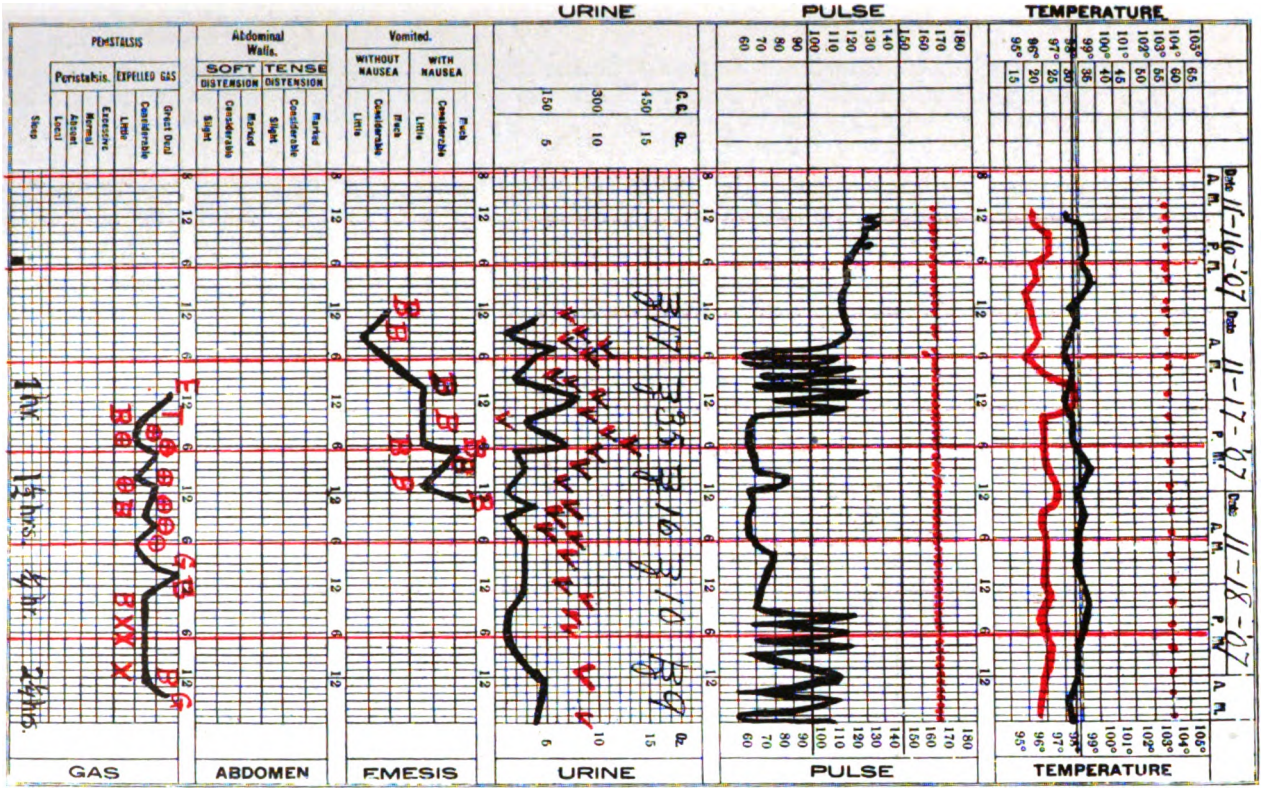

Fig. 18.—Cardiac dilatation. Digitalis poisoning. Large ovarian cyst. Weak heart. Orthopnea. Marked edema of extremities. Operation done with local anesthesia. Infusion of digitalis given by bowel for several days before operation.

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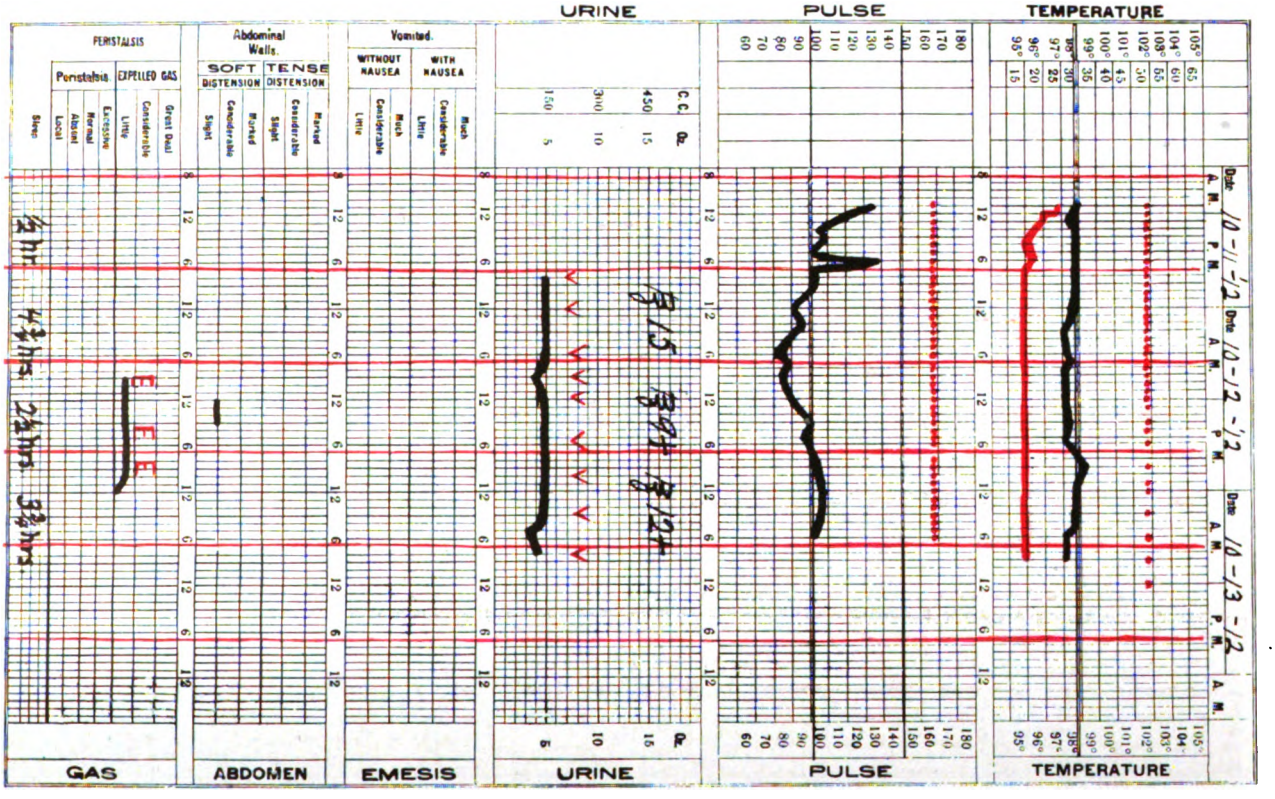

Fig. 19.—Sudden marked venous hypertension Recovery. Pulse came to normal. Abrupt rise in pulse-rate. Prompt response to posture and stimulants.

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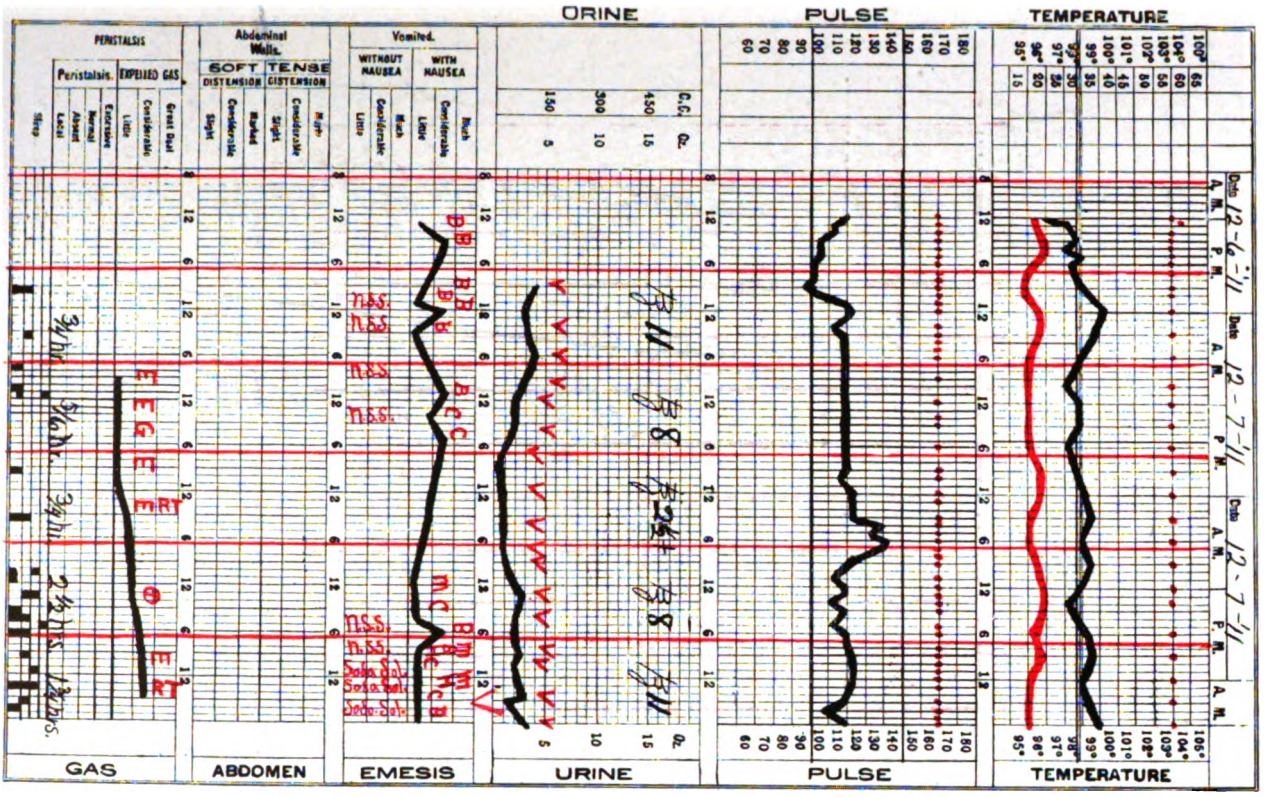

Fig. 20.—Pulse comes to 100. Dilatation after nine hours and again thirty-nine hours after operation. Recovery. Biliary poisoning; anemia; weak heart; depressed general health.

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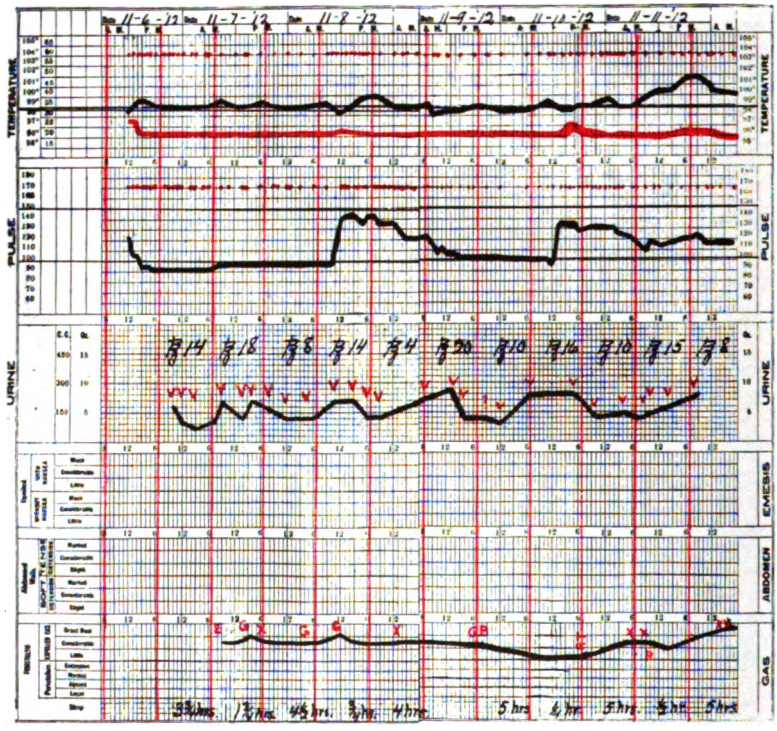

Fig. 21.—Cardiac dilatation. Recovery. Patient anxious and nervous about husband, whose heart has been dilated during course of pneumonia some months previously. Probably as a result of fright there was an acute cardiac dilatation after forty-six hours and another ninety-four hours after operation.

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Fig. 22.—Roentgenograms taken after three weeks and again four months after operation showed cardiac dilatation with return toward normal.

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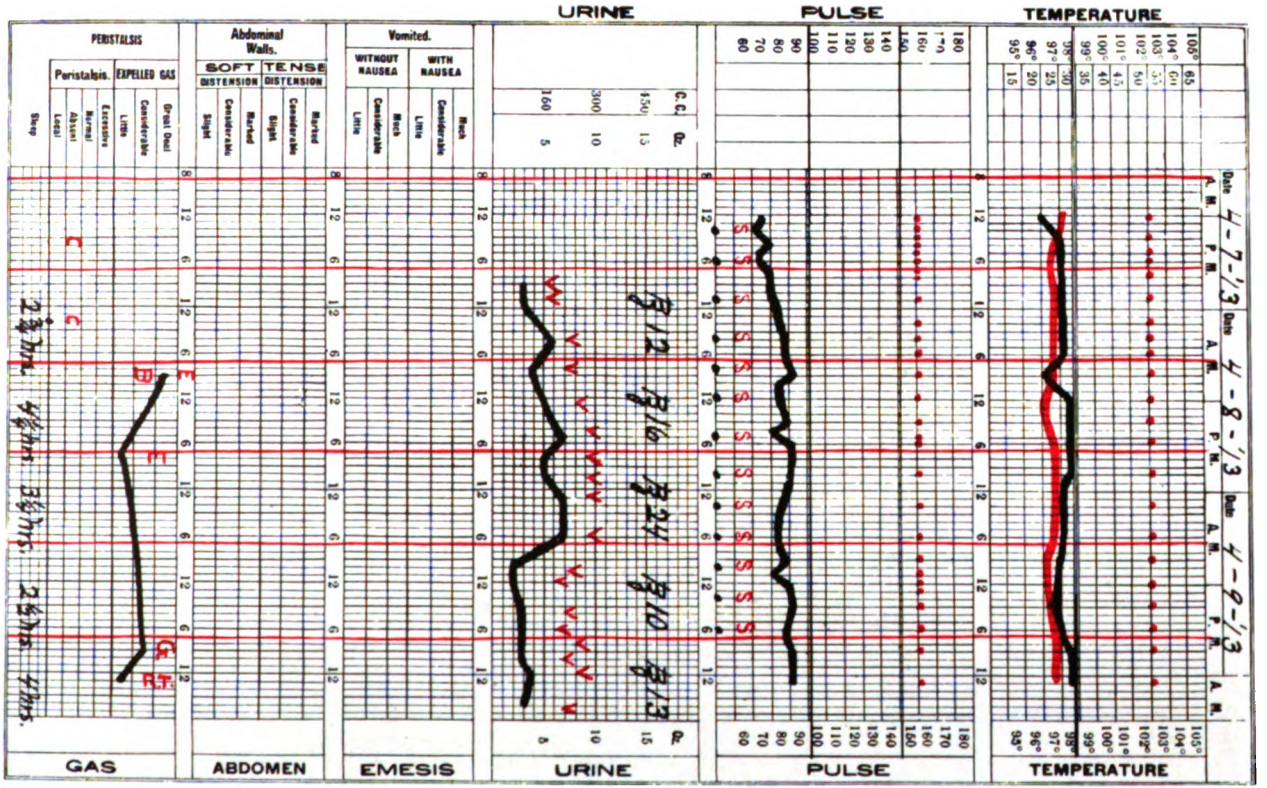

Fig. 23.—Patient, aged 67. Slight right-sided hypertension. Recovery. Weak heart, diffuse apex-beat, edema of extremities, dyspnea, renal insufficiency (chronic nephritis), frequent severe attacks of biliary colic. Gall-stones removed under local anesthesia. No appreciable change in pulse-rate or quality. This case forcefully illustrates the rule that when the vascular measurements were not relatively greater than the cardiac measurements, there was no circulatory embarrassment. In thirty-eight such cases there was no circulatory embarrassment.

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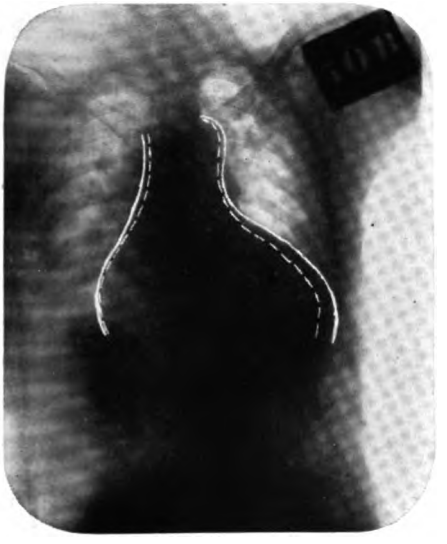

Fig. 24.—Postoperative roentgenogram showing slight uniform increase in vascular and cardiac areas. This case forcefully illustrates the fact that when the vascular measurements were not relatively greater than the cardiac measurements there was no circulatory embarrassment. In thirty-eight such cases there was no circulatory embarrassment.

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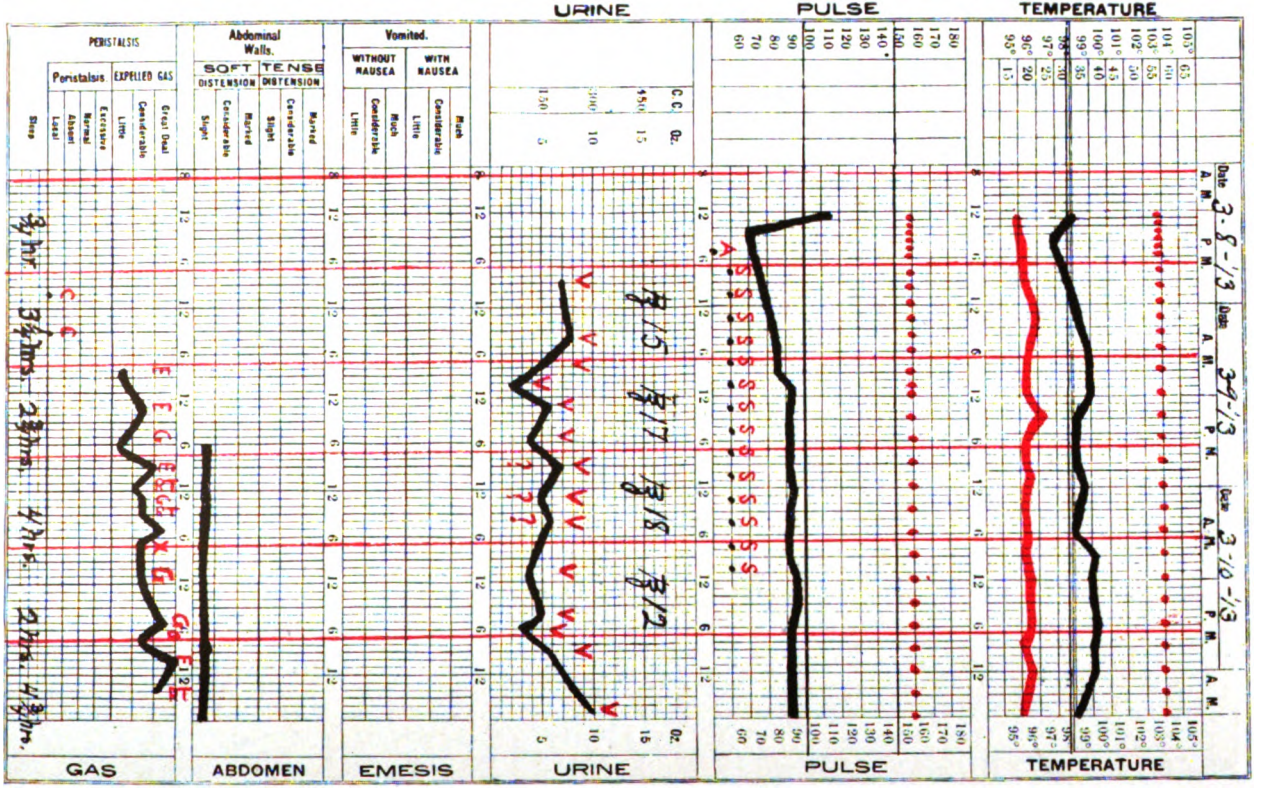

Fig. 25.—Slight circulatory disturbance during operation. Evidenced by a drop of forty beats in pulse-rate soon after operation. This was observed ninety-four times in 1,000 cases.

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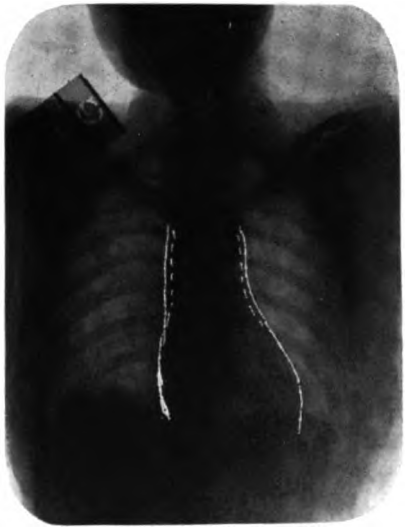

Fig. 26.—Postoperative roentgenogram showing increased vascular measurements with normal cardiac measurements.

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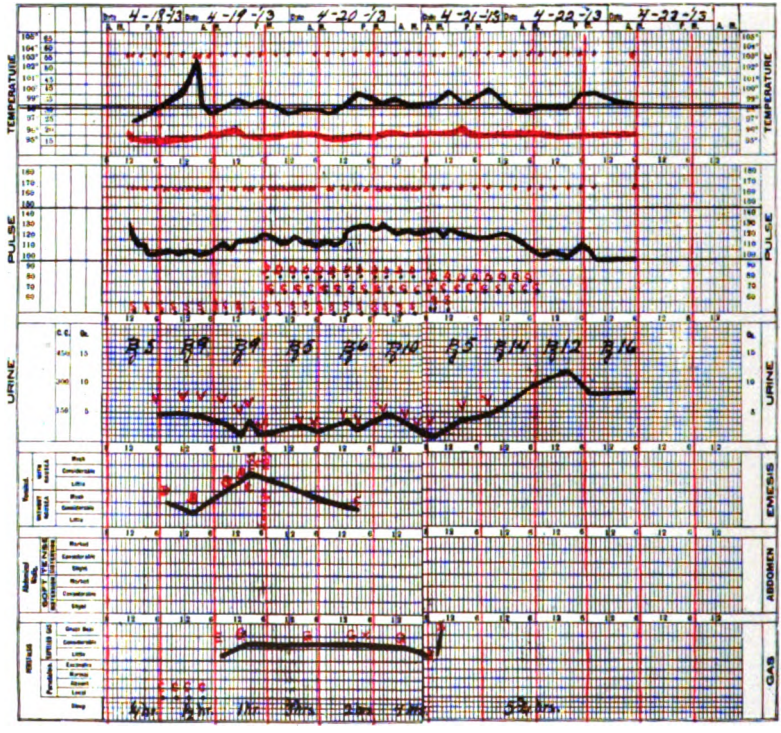

Fig. 27.—Right-sided hypertension. Recovery. Primary drop, then gradual rise of pulse curve. Hypertension demonstrated by fact that veins of hand did not empty until hand was raised 12 inches.

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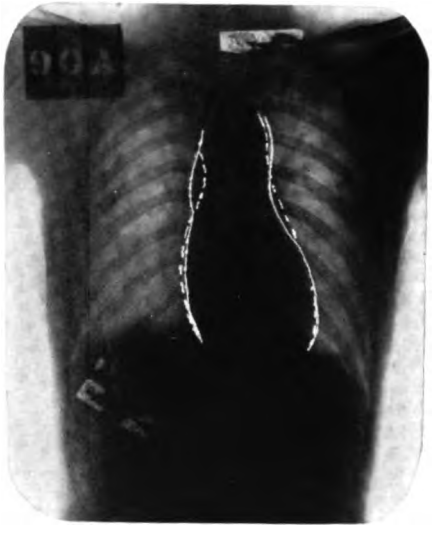

Fig. 28.—Postoperative roentgenogram showing increased vascular measurements with decreased cardiac measurements.

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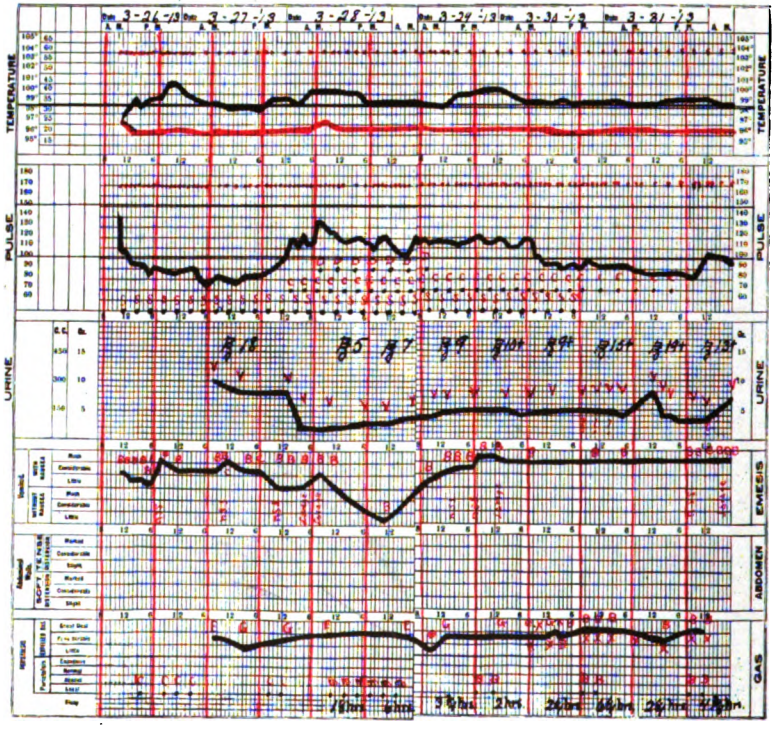

Fig. 29.—Circulatory embarrassment during operation. Sudden cyanosis; pulse rapidly rose to 140 and became weak toward end of operation. Prompt drop to 100 after operation. Cardiac murmur for twenty-four hours. Acute dilatation of stomach. Recovery.

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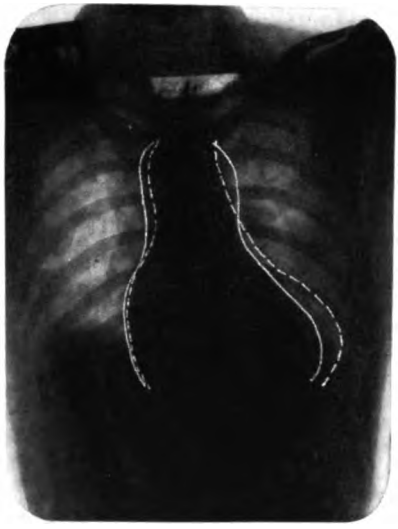

Fig. 30.—Postoperative roentgenogram showing increased vascular measurements with decreased cardiac measurements.

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one, 12 mm., three, 14 mm., two 15 mm., one 16 mm., and one, 17 mm.

CLINICAL OBSERVATIONS ON ONE HUNDRED AND FIFTEEN CONSECUTIVE ABDOMINAL OPERATIONS

A review of the clinical records shows that the post-operative course was perfectly smooth in seventy-six out of 115 cases, notwithstanding the fact that many who were considered poor operative risks had serious operations. The pulse in sixty-nine cases scarcely varied ten beats during the forty-eight hours. In the seven other cases, the pulse fell about forty beats from 120 or more within the first two hours and remained normal thereafter.

Twenty-six patients, all but one or two of whom were rather poor operative risks and yet required very serious operations, showed a rise of pulse-rate to 100 or less in four instances, 112 or less in twelve instances, 120 or less in six instances and 130 four times. In all instances the pulse promptly fell to the normal (within eight or ten hours) and remained so, the further convalescence being normal.

It is thus seen that 102 of the 115 patients ran a practically normal and perfectly safe course. In the remaining thirteen instances the pathologic condition was more grave, circulatory disturbances were more marked and the postoperative condition more serious. Three of these patients died. One of these patients, a woman aged 86, with gall-stones and large pancreatic abscess, died of pneumonia the eleventh day; the others died of peritonitis.

In no instance was the clinical picture of acute cardiac dilatation observed, though in one case there was decided cardiac embarrassment on the table as evidenced by cyanosis, weakness and marked acceleration of the pulse. In this case roentgenograms immediately after operation showed increased vascular measurements but decreased cardiac measurements. The patient developed a systolic murmur which lasted one day. May we not have had a transitory tricuspid insufficiency?

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A comparison of the postoperative condition of these patients and their clinical records with the Roentgen-ray findings is of some interest.

Though the typical clinical picture of marked increase in venous tension or acute cardiac dilatation was not observed in this series of 115 patients, minor changes were observed. They would seem to warrant the follow-in conclusions as regards right-sided hypertension:

1. When the vascular measurements were not relatively greater in proportion to the cardiac measurements, there was no circulatory embarrassment. In thirty-eight cases no embarrassment was observed.

TABLE 3.—CASES WITH NORMAL CIRCULATION IN RIGHT-SIDED HYPERTENSION WITH VASCULAR MEASUREMENTS NOT RELATIVELY GREATER THAN CARDIAC

Area		No. Cases.
Vascular.	Cardiac.	
Increased	Increased	22
Normal	Normal	8
Normal	Increased	7
Decreased	Increased	1

2. When the vascular measurements were relatively greater than the cardiac measurements, circulatory disturbance did occur in 24 per cent. of the cases. In fifty cases embarrassment was observed twelve times.

TABLE 4.—CIRCULATORY DISTURBANCES WHEN VASCULAR MEASUREMENTS WERE RELATIVELY GREATER THAN CARDIAC

Area.		No. of Cases	Normal.	Abnormal.
Vascular.	Cardiac.			
Increased ...	Normal	16	14	2 seriously ill.
Increased ...	Decreased ..	18	15	2 seriously ill; 1 had a drop of 40 beats or more on leaving table.
Decreased ..	Decreased ..	9	4	3 seriously ill; 2 had a drop of 40 beats or more on leaving table.
Normal	Decreased ..	7	5	2 had a drop of 40 beats or more on leaving table.

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It is our belief that these twelve cases represent the early stages of increased venous pressure or right-sided hypertension, and that if their circulatory apparatus had been somewhat further depressed, marked hypertension and then acute dilatation would have occurred in the following sequence: right auricular and ventricular and then left auricular and ventricular dilatation. Agencies which might readily have dilated these hearts are more ether, prolonged operation, prolonged extreme Trendelenburg position, or the *rapid* intravenous injection of considerable salt solution at the time the circulatory embarrassment existed.

SUMMARY

Right-sided hypertension does occur as a postoperative complication. It is usually slight and causes no symptoms. It occasionally causes circulatory disturbance, always with a rapid pulse. In rare instances it goes on to right auricular or even to cardiac dilatation.

It is more likely to occur when the myocardium is weakened by disease. It may readily be precipitated or intensified by excessive ether, prolonged extreme Trendelenburg position or by the rapid intravenous injection of large quantities of salt solution while the heart is already embarrassed.

It should be promptly recognized and treated by slight elevation of the head of the bed, a little morphin and cardiac stimulants.

ILLUSTRATIONS

In order clearly to contrast pulse-curves of right-sided hypertension with those of other postoperative complications, it has seemed advisable to place the illustrations in logical sequence and to refer to them in the text rather than to distribute them throughout the text.

Figures 1 to 5, inclusive, illustrate varying phases of venous and arterial pressure as shown by tracings taken on dogs.

Figures 6 to 12, inclusive, illustrate various pulse-curves typical of the complications they represent. They are shown here in order that they may be contrasted with the pulse-curves of venous hypertension.

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Figures 14 to 16, inclusive, illustrate increased venous or right auricular tension beginning during operation, with a pulse-curve which gradually comes to normal. In this group prolonged streptococcus and neisserian poisoning seem to have been the weakening influences.

Figures 17 and 18 illustrate preexisting cardiac disease and loss of complete compensation during operation, with prompt response to stimulation.

Figure 19 illustrates a heart weakened by old age (72), arteriosclerosis, chronic nephritis and large ovarian cyst.

Figure 20 typifies prolonged biliary poisoning with weakened heart yielding under strain.

Figures 21 and 22 illustrate the effect of fright and anxiety on the circulatory system.

Figures 23 and 24 strikingly illustrate the rule that when the vascular measurements were not relatively greater than the cardiac movements, there was no circulatory embarrassment. In thirty-eight such cases there was no circulatory embarrassment.

Figures 25 to 33, inclusive, would seem to indicate that circulatory disturbances may occur during anesthesia and that they may or may not pass quickly when the drug is withdrawn.

This series also presents typical illustrations of the general rule that when vascular measurements were relatively greater than the cardiac measurements, circulatory disturbances occurred in 24 per cent. of the cases. In fifty such cases slight embarrassment was observed twelve times.

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SOME NEWER METHODS OF REDUCING THE MORTALITY OF OPERATIONS ON THE PELVIC ORGANS

GEORGE W. CRILE, M.D.
CLEVELAND

Since the inauguration of the aseptic era the mortality-rate in abdominal operations has been falling steadily and to-day there are practically no deaths from simple abdominal operations for conditions unaccompanied by organic disease or infections.

This reduced mortality-rate is due in part to an improvement in technic, but very largely to the exercise of an increasingly critical judgment on the part of the surgeon in his selection of cases.

The technic has become standardized for such routine operations as the removal of benign tumors of the pelvic organs and for operations for chronic pyosalpinx, procidentia, prolapsus uteri, etc. The rare fatalities which occur in these apparently favorable cases result from some unforeseen and as yet uncontrollable factors such as embolism.

The results secured by the individual surgeon have come therefore to depend on two factors: his mastery of general operative technic and his policy in the selection of cases for operation.

The reclamation of the handicapped patient, however, has been and is one of the most cogent surgical problems. Mortality-rates would indeed be high were they based only on operations on patients with hypertension or hypotension, the result of infections or organic diseases; but I believe that even in these cases patients may be operated on successfully, not only without fatal end-

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results, but without the familiar train of disastrous sequelae, so disheartening to patient and surgeon alike.

If operations on handicapped patients can be postponed safely, the underlying causes of the hypertension or hypotension may often be combated successfully. Physiologic rest, diet and special therapeutic measures may avail to bring the patient to a condition in which operation may be safely attempted. The handicapped patient has been searchingly studied by the able chairman of this section, Dr. Simpson.

Our problem is (1) to discover what may be the special risks when operation cannot be postponed; and (2) to evolve means by which those risks may be obviated or minimized.

The natural sequelae in hypertension cases are embolism, thrombosis, renal insufficiency, angina, pneumonia and cardiac failure. The same train of disastrous results may be seen in persons with hypertension who have been injured in accidents, and also in physically uninjured persons who have undergone some severe psychic shock. Since both psychic and physical strains produce identical results in patients with hypertension, it would seem that the seat of danger must be found at the final point of meeting of both psychic and physical impressions—that is, in the brain tissue.

A long series of laboratory experiments on animals subjected, some to emotional excitation, and others to physical trauma under anesthesia, showed that identical brain-cell changes were caused in each case. That is, both physical and psychic stimulation exhaust the physical substance of the brain cells. Emotional stimulation not only causes brain-cell deterioration, but produces also an increase of the internal activating secretions—epinephrin, thyroid secretion, glycogen—a vital point in cases of hypertension.

A logical conclusion from these experiments was that if an operation could be so performed that no traumatic impulse could reach the brain, and if in addition all

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emotional stimuli connected with the operation could be removed or reduced to a minimum, then the dangers of operation would be those only which would result from the local injury inflicted. Brain-cell exhaustion would be prevented, as would the disastrous effect of the presence in the body of increased amounts of the energizing products of internal secretions.

TECHNIC

From these premises I have evolved an operative method which I have named anoci-association because by its use all nocuous, or noci-associations are cut off from the brain. The complete operative procedure under this principle includes a lessening of the pre-operative psychic strain by the administration of solacing drugs; the administration of a general inhalation anesthetic to obliterate harmful impressions in the course of the operation; the progressive use of a local anesthetic to prevent the passage to the brain of traumatic stimuli from the field of the operation, and finally the use of a local anesthetic of lasting effect that the tissues may be kept relaxed and that painful after-effects may be eliminated or minimized.

In such an operation the brain cells have been subjected to no exhausting strain from painful impulses received through contact ceptors; and since the special senses have been closed to all impressions no psychic stimuli have reached the brain, so that the energizing organs in turn have not been pushed to increased activity.

From an operation conducted after this technic the patient with hypertension will emerge not only no worse for the experience, but it may be in actually better condition, because the body and brain have been so completely at rest.

The same technic avails also for the patient with hypotension whose brain cells are already weakened and exhausted by the anemic condition. In hypotension we have a definite and efficient remedy, for the condition is logically to be met by direct transfusion of blood; as

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occasion demands, this may be done several days before, just before, during the operation, or immediately thereafter. In these cases of hypotension, however, the margin of safety is much reduced, for some brain cells may have deteriorated from exhaustion beyond the power of resuscitation by rest or transfusion, so that it is of vital importance so to perform the operation that the already diminished resisting powers of the patient may not be further depleted.

In addition to the psychic and traumatic dangers in operations on handicapped patients, one other operative factor—the anesthetic—should receive most careful consideration.

Ether anesthesia has certain advantages. It is relatively safe in inexperienced hands; its bulk is small; it is inexpensive; it requires the simplest apparatus for administration. Against ether, however, stand certain ill effects, objectionable always, but of peculiar danger to patients with hypertension. However skilfully it may be administered it always induces a period of psychic stress in the earlier stages of its administration; the strain of ether nausea and vomiting is especially dangerous in these critical cases which we are considering; the dose of ether required to dissolve the lipoid in the brain sufficiently to cause anesthesia dissolves also the lipoids in the liver, the kidneys, the red blood-corpuscles and other important structures. Ether also chemically hinders or prohibits phagocytosis; hence it may produce nephritis and pneumonia, and, of vital importance in hypotension cases, anemia. Ether immediately impairs the immunity of the patient so that infections find a ready recipient.

I have therefore made nitrous oxid the anesthetic of choice, because it is devoid of harmful after-results, and serves as a measurable protection against shock, since by its hindrance to oxidation it diminishes brain-cell changes —a fact which I have established experimentally. It is an expensive anesthetic and should be given only by a specially trained and skilful anesthetist, objections which

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can have no weight as compared with the resultant advantages to the patient derived from its use.

The complete technic in abdominal operations is as follows: When the preoperative strain is great, an hour or so before the operation the patient is given a hypodermic injection of 1/6 grain of morphin and 1/150 grain of scopolamin, that he may receive the solace and quiet which come from the use of these drugs. In exceptional cases the inhalation anesthetic may be administered in the patient's room; or else, in the apathetic state produced by the morphin and scopolamin, the patient is conveyed gently to the operating-room, where a specially trained anesthetist administers nitrous oxid. When the patient is anesthetized the division of tissue is preceded by nerve blocking by means of the local administration of 1:400 solution of novocain. Each division of tissue in the course of the operation is preceded by the infiltration of this local anesthetic, the block being made so complete that no nerve is left free to carry a single activating impulse to the brain. First the skin, therefore, then the subcutaneous tissue, then the fascia, and finally the remaining muscle or posterior sheath and the peritoneum are in turn novocainized, subjected to momentary pressure to spread the anesthetic, and then divided within the blocked zone. If the blocking has been complete, then on opening the abdomen there will be found no increased intra-abdominal pressure, no tendency to expulsion of the intestines, and no muscular rigidity.

The peritoneum is next everted and a 0.5 per cent. solution of quinin and urea hydrochlorid is infiltrated about the line of proposed sutures, and, as before, the parts are then subjected to momentary pressure. This infiltration serves as a block, and as its effects last for several days it should prevent or at least minimize the postoperative wound pain and the postoperative gas pain, and by so much minimize postoperative shock. The quinin and urea salt causes a certain amount of edema of tissue, which lasts for some time after the wound is

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healed. The relaxed abdominal wall will permit exploration of the entire abdominal cavitv with ease. If there is no cancer or acute infection in the field of operation, then the following regions may be blocked as completely as, and in the same manner as, the abdominal wall, namely, the meso-appendix, the base of the gall-bladder, the uterus, the mesentery and any portion of the peritoneum. In performing a hysterectomy the broad and round ligaments are thoroughly infiltrated with novocain before they are severed, and again before the wound is closed the stumps may be completely infiltrated with quinin and urea hydrochlorid, thus giving a degree of anesthesia for at least two days. On account of the absence of nociceptors, operations on the stomach and intestines made without pulling on their attachment cause no pain, and hence the novocain infiltration of these viscera is not required. If the brain has received no stimuli during the operation, then the closure of the upper abdomen is as easy as the closure of the lower; all is done with the ease of relaxation.

What is the result? No matter how extensive the operation, no matter how weak the patient, no matter what part is involved, if *anoci* technic is perfectly carried out the pulse-rate at the end of the operation is the same as at the beginning. The postoperative rise of temperature, the acceleration of the pulse, the pain, the nausea and the distention are minimized or wholly prevented.

RESULTS

I have described the complete anoci operation. What is its effect on the postoperative conditions—the morbidity and the mortality? Let us take each morbid manifestation in turn.

1. *Postoperative Pain.*—Quinin and urea hydrochlorid wholly prevents pain if it is injected into the entire wound. But quinin and urea cause some edema of the wound; hence one should limit the wound infiltration to cases needing it, that is, bad risks generally.

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2. *Postoperative Gas Pain.*—This baffling phenomenon may be largely or wholly prevented by the technic described, that is, by the hypodermic infiltration with quinin and urea hydrochlorid of a wide margin of tissue, including every part of the divided peritoneum. The stitches must be inserted within the blocked zone. Postoperative gas pain can be explained as a biologic adaptation to overcome infection. In the course of evolution all abdominal penetrations are infected, but the peritoneum is able to overcome most infections if they can be localized. To localize an infection the intestine and the abdominal wall must be kept fixed against each other; that they may do so each must be inhibited; the intestine must be distended with gas, the abdominal wall must be rigid. If the intestine be distended with gas and fixed, then digestion must cease. If digestion be arrested then there is anorexia, or even vomiting to expel food from the stomach. This shows us how postoperative gas pain is due to a biologic adaptation to overcome infection, and explains its resemblance to incipient peritonitis. Nature does not depend on the surgeon or perhaps she knows the surgeon too well. The test of this hypothesis is easily made. If the brain, through which this adaptive response is made, is kept in ignorance of the incision into the peritoneum (*a*) by progressive novocain blocking throughout the operation and (*b*) by postoperative quinin and urea blocking to prevent later communication with the brain through stitch tension, then there should be no gas pain. Clinical experience has abundantly confirmed this hypothesis. It must be remembered that if a single nerve filament escapes the block there will be gas pain.

3. *Painful Scar.*—I postulate that the lesion of a painful scar is in the brain, not in the scar; that it is due to the low threshold produced by injury, and is intimately connected with a fundamental principle of nerve conduction. This fundamental principle relates to the fact that a strong traumatic or psychic stimulus produces some change in the conductivity along its cerebral arc, the

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effect of which is that of lowering the threshold of that arc. This might be illustrated by the phenomena following a hold-up at the point of pistol at a street corner. For a long time after such a psychic stress any association with that particular corner would recapitulate the experience. In this manner throughout life the various experiences may lower the threshold in innumerable ways. I assume that there is a similar result after a traumatic stimulus. The arc receiving the stimulus suffers a lowered threshold and hence from that time on mere trifles become adequate stimuli. Such a result is seen in the sensitiveness after fractures and in the painful stumps of crushed limbs. Now, if an operation is so performed that no strong stimulus reaches the brain either during or after the operation, then the thresholds of the cerebral arc from the wound will not be lowered. Since the threshold is not lowered, contact with the scar or any injury to that part will have no more effect than will contact with any other part of the body. In other words, the scar will be no more sensitive than is the skin elsewhere. Hence we see how painful scar may be prevented by complete anoci. Clinical data seem to support this hypothesis, although it has not as yet been fully worked out.

4. *Nervousness.*—When in the night one is threatened with an unknown danger, the brain threshold is always lowered, apparently as an adaptation to the more swift and accurate detection of the danger. Likewise, when one has received a crushing physical injury there is a universal lowering of the threshold. During these states of tenseness minor stimuli have major effects, or, in other words, one is "nervous."

Now, as we have seen, the subconscious brain is tortured directly during unblocked operations under inhalation anesthesia. The resultant general effect on the brain thresholds is demonstrably the same as if the injury had been inflicted without anesthesia, that is, after the punishment of the subconscious mind during an operation the patient emerges "nervous" and "exhausted";

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and since a low threshold is lavish in its waste of nervous energy, recuperation is slow. Hence there results a period of postoperative nervousness, of postoperative loss of efficiency. It is obvious, and clinical experience abundantly proves this, that the threshold is preserved by complete anoci; hence the unpleasant, damaging postoperative phenomena are avoided.

5. *Aseptic Wound Fever.*—Since it is a physical law that any form of force may be converted into heat, and that heat thus produced, if not at once transformed into motion, must increase the temperature of the body affected, we see readily why any stimulus, mechanical or physical, which normally would increase motor activity, must cause a rise in temperature if complete motor expression is impossible. Anything, therefore, that drives the motor mechanism of the body beyond the point of normal expression will cause fever. Anger, athletic contests, fear, physical injuries, all produce a rapid oxidation of certain body compounds too great for complete translation into motion.

In operations under general anesthesia only, we expected routinely to see some postoperative rise of temperature as a result of the suppressed power of motor response to the physical and psychic injury; but by the use of anoci-association, both during and after the operation, I discovered no change in the postoperative temperature and pulse-rate. I therefore was forced to the conclusion that, barring infection and the absorption of hemoglobin, postoperative fever is the result of increased oxidation, this being in turn the result of the psychic and traumatic stimuli of the operation to which the natural response had been denied.

So much for the postoperative morbidity. Not only does the surgeon, but also the patient, the intern and the nurse corroborate the story.

As for the mortality-rate, hospital statistics abundantly verify our conclusion. At the Lakeside Hospital since the introduction of this method, my associate, Dr. W.

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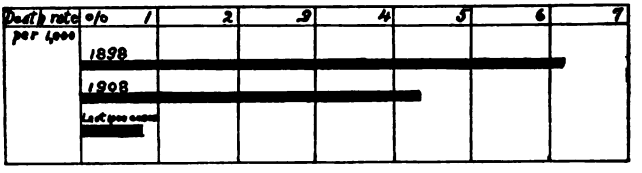
E. Lower, and myself have performed 250 pelvic operations, with but two deaths, a mortality-rate of 0.8 per cent.

Although my purpose in this paper is to deal only with pelvic operations, a word may be added regarding the application of this principle in a general surgical practice. Last year Dr. Lower and I performed 729 abdominal sections of every grade with a mortality-rate of 1.7 per cent., and in the Lakeside Hospital service, where all kinds of acute emergencies are met, and where most of my own private work is done, there were performed by my associates and me in the past year operations on 2,672 patients with a mortality-rate of 1.9 per



Comparative mortality rate of the Lakeside Hospital Service. The first line shows the mortality rate when the hospital was first opened in 1898. The second line shows the mortality rate for the year before the anoci technic was introduced. The last line shows the mortality of the last 1,000 patients operated on at the Lakeside Hospital by the resident staff, Dr. Lower and myself.

cent.—a result never before approached in that hospital. In the last thousand operations performed by Dr. Lower and myself, these operations including every risk in a general surgical practice, the mortality-rate has been 0.8 per cent.

Osborn Building.

ABSTRACT OF DISCUSSION

Dr. Henry O. Marcy, Boston: The matter presented shows clearly that the dynamic energy of the individual is the thing to be preserved. While a student in London, in 1870, Sir James Paget said to me, "Dr. Marcy, do you know how to give ether?" They had had twelve deaths in the city from chloroform in the previous six weeks, and I had the opportunity of administering ether, the first time, he said, that it was ever given in London. I gave it after the old-fashioned method which we were taught in the Massachusetts General Hospital and submerged my patient, but, fortunately, not to her death. Fifty years ago we gave chloroform in the U. S. Army, but it was given carefully and there were comparatively

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few accidents. When we give alcohol — and ever remember that ether is an acute alcoholic poison — we must know that we are lessening the dynamic energy of life, that we are lessening the circulatory power, and, consequently, lowering the resistance of the patient. Thus, it behooves us, in whatsoever way we give an anesthetic, to remember, first, the emotional conditions of the patient himself, and then study carefully the conditions before we operate as well as during the operation.

Dr. C. O. Thienhaus, Milwaukee, Wis.: I should like to ask Dr. Crile whether or not he would think it advisable to use the injections for the purpose of producing local anesthesia in cases of extra-uterine pregnancy with acute hemorrhage? I believe that for such cases the operation in the so-called "exciting stage of ether anesthesia" is the best method because it saves time. I feel furthermore that the fact is much overlooked that it is entirely wrong to transport these patients to a hospital. They must be operated on at home as rapidly as possible. Some of these patients who are almost pulseless hardly need any anesthetic at all and still, by prompt interference, quite a few of them have been saved, as can be shown by statistics.

Another fact ought not to be forgotten, and that is that the severest cases of general peritonitis following perforations, as well as the severest cases of internal hemorrhage never reach a hospital and, therefore, are not included in the statistics of hospital surgeons.

Dr. Arthur E. Hertzler, Kansas City, Mo.: There are two points which I should like to bring out: (1) the short duration of novocain anesthesia—not over fifteen minutes, too short to be of much use as a block; (2) the question of hyperesthesia in the regions anesthetized. In the use of a local anesthetic we obtain an exquisite hyperesthesia which may last for days. If this region is made the object of any irritation by suture or otherwise, it is a constant source of irritation and defeats the purpose. I have been working on this problem ever since my assistant called attention to the value of local anesthesia for the lessening of the pain, and we still have little to offer. In the transversalis and the parietal peritoneum, in which the chief difficulty lies, the nerve-supply is exceedingly complex. The nerves come in external to the fascia of the transversalis and ramify external to the parietal peritoneum. How any one is going to block any particular area and keep from striking a set of nerves around the hyperesthetic area we have been unable to determine. What we have demonstrated is that much can be gained by avoiding the nerve areas in all kinds of traumatism, whether it be by suture, forceps or some other means. It is useless to infiltrate tissues that contain no nerves. I should also like to make a point, particularly for personal information, regarding Dr. Crile's statement that

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quinin produces edema. We have made a careful histochemical study of the effects of quinin on the tissues, and we have not observed that there is any edema produced. We do get an exudate of a granular fibrin in many instances, particularly if the use is excessive, but have never observed that either cellular or edematous infiltration takes place.

DR. GEORGE GELLHORN, St. Louis: It seems to me timely to point out that spinal anesthesia preeminently belongs among the newer methods of reducing the mortality of pelvic operations. It is this method above all others that fulfils all the postulates of anoci-association. The brain of the patient does not know anything of the operation and consequently there is no shock. I can also confirm Dr. Crile's statement, that, because of the blocking of nerve impulses, gas pain is considerably less after spinal than after ether narcosis. It is not altogether absent, but reduced to a marked extent. I hope that Dr. Crile will define his views on spinal anesthesia in his closing remarks.

DR. GEORGE W. CRILE, Cleveland: Replying to Dr. Thienhaus' question: Of course, if one encounters an emergency of any kind, the method is not satisfactory outside of the hospital. That question must be settled on its own merits. One would not feel like abondoning a great surgical principle simply because it could not be applied to patients outside the hospital. I am speaking of patients on which this technic can be carried out. Of course, it is quite important to arrest the hemorrhage early. I am sure we all agree to the remark Dr. Thienhaus made.

All that I can say with regard to Dr. Hertzler's points is that it is a clinical fact that by local infiltration one can anesthetize the abdominal wall or any other tissue, if the work is done carefully and well. If one makes a complete infiltration and applies local pressure immediately, a local anesthesia can always be secured. I do not mind particularly what the ultimate facts are regarding the tissues so long as the end is accomplished. I am glad to have Dr. Hertzler assure us that there is no edema; but, I notice this: Quinin and urea hydrochlorid do produce a certain amount of swelling in the wound afterward, more than any other agent I know of. Novocain does not produce any swelling at all. I wish Dr. Hertzler would tell us how we can avoid the swelling which follows the injections, because these injections give something to our operations which we have never before secured. I am ready to be convinced that spinal anesthesia is a safer form of anesthesia than can be secured by our methods. It is because I have not been sure that spinal anesthesia is the safest that I have gone to the trouble of working out the nerve-blocking system. Considering our remarkably low mortality-rate and our marked control over our patients, I should not be willing to give up this method until I was sure that the substitute would be quite as safe.

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POSTOPERATIVE RENAL INFECTION

HENRY DAWSON FURNISS, M.D.
NEW YORK

Postoperative renal infection may occur from an infection in some other part of the urinary tract, or be first in the uropoietic system. Already existing infections of the kidney pelvis may be the source of infection for infection of the renal parenchyma.

Independent of operation, renal infections occur during typhoid, attacks of tonsillitis, furunculosis, or from carbuncles and paronychiae. While any one of these causes may exist after operation and be the real etiologic factor of the renal infection, only such infections as occur as a direct result of the operation or its complications are here considered.

Baisch[1] states that in healthy women the urethra is seldom the seat of pathogenic bacteria, but that in those post partum, and after operation, the urethra becomes the habitat of infectious micro-organisms, and that the number present is in direct ratio to the length of time that the woman remains in bed. To this might be added that in the cases post partum and in operation attended with a discharge that bathes the urethra, the organisms are more plentiful. Such bacteria are then introduced into the bladder by catheterization, no matter what care is taken to cleanse the external genitals, and in a bladder already injured and not able to empty itself, cystitis is very apt to take place. This is especially frequent in patients operated on radically for carcinoma uteri.

1. Baisch: Ztschr. f. Geburtsh. u. Gynäk., 1904, viii.

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A. Bauersein[2] found in eighteen autopsies following operation for carcinoma, cystitis in all, but no evidence of the infection extending through the bladder wall. He regarded the granulation tissue as a barrier to such extension, and found no bacteria beyond this. He considered the bladder infection as being due to introduction of infectious material through the urethra, or due to infection passing downward from the hematogenously infected kidney.

Sugimura[3] found in twenty-five cases of cystitis, involvement of the lower end of the ureter in all, and demonstrated that the infection in all extended along the lymphatics and not in the ureteral canal. Bauersein demonstrated that when the ureters had been extensively dissected they subsequently became embedded in a mass of indurated tissue. In these two ways a certain amount of stasis is produced, conducive to infection in whatever way it is introduced.

In extensive operations for carcinoma, in addition to the other causes above mentioned, the large amount of wound secretion flowing over the urethral orifice tends to urethral infection.

From the cystitis, infection may reach the kidney along the urethral channel, through the blood or the lymphatics. In proof of the first assertion, Stoeckel offers the history of a case in which from the lower end of the ureter urine containing pus was obtained, while from a point higher was drawn clear urine. In spite of this, many authorities doubt the ascent of infection from the bladder. In many of the experiments in which the urethra is ligated, and infection, first of the bladder, and then of the kidney, occurs, this infection may as well be explained on the hematogenous theory as that of ascension of the ureter, the organisms gaining a port of entry through the wound caused by the ligation. F.

2. Bauersein, A.: Ztschr. f. gynäk. Urol., 1913, iv, No. 1.
3. Sugimura: Virchows Arch. f. path. Anat., October, 1911.

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Pawlik[4] is a believer in hematogenous infection of the kidneys in cases of cystitis.

A. Bauersein proved in his necropsies on the patients dying after the Wertheim operation for carcimona, that occasionally the kidney and the perinephritic tissue became infected through the lymphatics coursing along the ureter.

In the same articles he states that he believes hematogenous infection, with the port of entry the operative wound, is more usual than is generally believed. Lichtenberg[5] thinks too much stress has been laid on ascending infection of the renal pelvis, and considers the hematogenous route the more frequent.

Franz Jaeger[6] reports two cases of acute infection of the renal paryenchyma in kidneys which were the seat of chronic pyelitis. One of these appeared to be an extension upward through the urinary tubules and the other a hematogenous infection, the lesions being multiple abscesses in the cortex. Dr. F. E. Sondern of New York has in his collection a very fine specimen of acute hematogenous infection of the cortex of a kidney, the seat of chronic pyelitis.

There are many instances of postoperative renal infection in which there has never been any catheterization of the bladder, antecedent cystitis, nor previous infection of the urinary system.

In a footnote on a lecture on colon bacillus infection of the kidney Harry Fenwick[7] speaks of the frequency of infection following operations for hemorrhoids. Here three causes are present: (1) Surface lesions in an infected area; (2) congestion of the vesical neck; (3) retention of urine. Piero Poleenigo[8] reports a case of metastatic multiple renal abscesses, following operation for hemorrhoids.

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4. Pawlik, F.: Med. Klin., 1912, No. 43.
5. Lichtenberg: Therap. Monatschr., June, 1912.
6. Jaeger, Franz: Ztschr. f. Gynäk., cxi, Part 4, Ztschr. f. Gynäk., Urol., iii, No. 4, 1912.
7. Fenwick, Harry: Clin. Jour., London, Feb. 2, 1910.
8. Poleenigo, P.: Folia urolog., 1911, vi, No. 5.

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It has seemed to me that renal infections are more apt to occur when there has been some operation on the intestinal canal, or when there is a wound that is apt to be contaminated by intestinal contents. Baisch contends that the colon bacillus is seldom the primary factor, but that it subsequently is added and then supplants the other organisms. The fact that so many of these cases follow wounds especially apt to be contaminated by intestinal contents, rather speaks against this claim.

Possibly the constipation incident to postoperative intestinal peristalsis, and the purging used to overcome this may account for some of these cases.

It has been demonstrated that the kidneys can excrete bacteria without being harmed, and it is necessary that the bacteria lodge and develop to produce pathologic lesions. The extent of the damage depends on the point of lodgment, the number and virulence.

The fact that many of these infections do not occur right after operation, but days later, make me think the infection is started from the breaking loose of thrombi from the vessels of the wound region. Points in favor of this are that usually after operation there is something indicating infection and that the acute condition is sudden.

The symptoms of infection of the kidney after operation depend on whether the pelvis is involved from an extension up the ureter, or the parenchyma is involved primarily through the blood. In the first instance there is apt to be a history of cystitis which on involvement of the pelvis of the kidney is attended with pain in the lumbar region and along the ureter, with a rise of temperature, with or without chill. Unless there is some retention in the pelvis, pain is absent, and there is little aside from moderate temperature to call attention to such an extension.

SYMPTOMS

In the acute hematogenous infections, which usually affect only one kidney, during convalescence, without

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any warning there is a sudden rise of temperature, sometimes preceded by chilly sensations or by a distinct chill. The temperature is generally marked by decided remissions. Pain may or may not be present in the affected kidney. Other constitutional symptoms are dependent on the severity and the character of the infecting organism. While the colon bacilli infections are attended with chills and high temperature, the constitutional disturbances are not so marked as in other infections. Often there is delirium and other evidences of disturbance of the sensorium. At first there is apt to be lessened frequency of urination due to decreased fluid output by the kidneys. Later when the ureter and bladder become involved there is frequency.

DIAGNOSIS

Early in the disease there is little in the urine to help in the diagnosis. At first it is usually high-colored, as in any other marked febrile condition. Bacteria may be isolated by culture. At the beginning there is not apt to be pus in the urine, and according to Münnich[9] this is especially so in the instances of colon bacillus infection. Later, pus casts, and at times blood, are to be seen in a urine that is highly albuminous. After involvement of the pelvis, pus is found in greater quantities.

SUMMARY

There are the three types of postoperative renal infection—through the blood, lymph-channels, and up the ureter. I think the ascending infection through the blood is the most common, and that the latter is much more frequent than is generally supposed.

The late occurrence of the infection, and the fact that most of the patients have had some rise in temperature immediately following operation, lend weight to the theory that the origin of the infection is from thrombi at the seat of operation.

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9. Münnich: Arch. f. klin. Chirurg., xcviii.

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Renal infections are probably more frequent than is imagined and will be detected oftener when the surgeon bears this in mind.

Below I have briefly given the histories of several cases. The hair-pin case does not properly fall within the scope of this paper, but it is inserted, as I believe the renal infection was hematogenous, the point of entrance of the bacteria being through a wound caused by the pin.

CASE REPORTS

CASE 1.—Mrs. R., a patient whom I saw in consultation with Dr. Perry S. Boynton, to whom I am indebted for the notes and the privilege of reporting the case, had one child eighteen months before her operation, April 5, 1912. The examination of the voided urine before operation showed a few red blood-cells and a few pus cells. The operation was a curettage, trachelorrhaphy, perineorrhaphy, appendectomy for chronic appendicitis, and freeing of adhesions of the left tube and sigmoid. Symptoms were promptly relieved and the patient made a good recovery and left the hospital April 20.

While waiting for a car on an exposed corner the patient became chilled. Two days later she had a distinct chill, followed by fever and a dull aching pain in the left lumbar region. The next day Dr. Boynton saw her and found a large tender left kidney; at this time the temperature was 103 and pulse 120. Two days after this the right side was similarly affected. There was pus and colon bacilli in the urine. Dr. Boynton made a diagnosis of bilateral pyelitis. She was given intestinal and urinary antiseptics, and colonic irrigations. The condition persisted with exacerbations and remissions for six weeks.

June 8 she returned to the hospital and on June 12 and 14 I catheterized both ureters, obtaining from them urine with a moderate amount of pus and colon bacilli. Each time I irrigated the pelvis with 1:500 silver nitrate solution. In the next ten days the symptoms gradually improved, and she was able to leave the hospital June 26. After that she gained rapidly in strength and weight and became pregnant for the second time in October. She manifested no further urinary symptoms, and at the eighth month the voided specimen showed only an occasional pus cell.

Remarks: There were a few pus cells in the urine before operation, but as this was a voided specimen there is no certainty that they came from the urinary tract. The patient was catheterized twice after operation. It is possible that the chilling experience on the trip home may alone have accounted for the kidney infection, or may have produced a certain

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amount of renal congestion that would favor other factors. The apparent beneficial effect of the pelvic lavage is to be noted.

CASE 2.—Mrs. A. L., aged 33, was seen first in February, 1910. Menses began at 14, occurring regularly every four weeks; moderate in amount, with severe pains in the lower abdomen on the second, third and fourth days. Soon after marriage she became pregnant and had to be aborted on account of pernicious vomiting at the third month; this was nine years ago. The menses after this were scanty. Within a few months after the abortion she had appendix and both tubes and ovaries removed. She is not certain of the conditions that necessitated such an operation.

A week or ten days after the operation patient had a chill, rise of temperature, and pain in the abdominal wound, which broke down. Three weeks after operation the patient took a full bath; following this she had severe pain in the right kidney region for a week. At first there was some blood in the urine, and marked frequency of urination. The patient thinks she had a rise in temperature for a few days at this time. After this she did not feel well, and about every four to eight weeks she had attacks of pain in the right lumbar region, sometimes associated with vomiting and sometimes with temperature. Had frequent urination and moderate pyuria after the primary attack. I saw her first three years ago, when a diagnosis of colon bacillus of the right renal pelvis was made. As this did not clear up promptly under the administration of hexamethylenamin, I catheterized the right ureter and instilled into the pelvis half an ounce of 1 per cent. nitrate of silver solution. Since then she has never had any pain in the kidney region and the pyuria and the frequency of urination have disappeared. The patient has since been in better health than at any time after the operation.

CASE 3.—Mrs. A. G., aged 27, seen through the courtesy of Dr. Edward Pinkham, was admitted to the hospital Dec. 8, 1908. She had had two children and two miscarriages, all uneventful. Her menstrual history had been normal until the month before entering the hospital, and in this time she had flowed, off and on, for two or three days at a time, profusely. For the week just before entering she had no flow.

December 9 she was curetted and the uterus swabbed with tincture of iodin and phenol (carbolic acid). She was catheterized three times in the thirty-six hours after operation.

December 17 she complained of some bladder discomfort, and the next day of some pain in the back. On December 20 she was still complaining of pain in the back, and there was a sudden rise of temperature in the early morning to 101.8 F., which increased to 104 in the afternoon. At this time the pain in the back seemed to be more acute on the left.

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December 21 I employed the cystoscope and found a slight cystitis. Both ureters were catheterized and from both was obtained highly colored, turbid urine, containing pus and pus cells, more from the left. The same results were obtained on December 22.

As the patient was not improving, on December 24 Dr. Pinkham cut down on the left kidney, which was large, congested and was dotted with many small infarcts. An incision was made through the cortex into the pelvis.

Blood-counts on December 26 showed 14,000 leukocytes, 80 per cent. polynuclears, 15 per cent. small lymphocytes, 5 per cent. large. On December 28 the count was 11,000 leukocytes, 70 per cent. polynuclears, 19 per cent. small, and 5 per cent. large lymphocytes.

Following the operation the patient did not improve, and ran a high temperature, which gradually fell to normal Feb. 3, 1909, and there remained.

Until January 21 there was marked albuminuria, with hyalin, finely granular, at times pus, casts and much pus in the urine. Even at the time of her discharge, January 30, there was a marked amount of pus in the urine.

She returned to the clinic after six weeks, when we found that she had pus coming from both kidneys. This was cleared up after a few nitrate of silver injections of the renal pelvis.

I have to thank Dr. Burton Harris for the report of the next two cases. They were included in his paper on renal infections which he read at the Boston meeting of the Urological Society.

CASE 4.—Mrs. M. W., aged 24, housewife, was seen in consultation with Dr. Charles Wuest and Dr. Rudolph Herriman Feb. 1, 1912. The records show that there had been an instrumental delivery of a normal child on Dec. 1, 1911. There had been no vesical or renal symptoms during pregnancy and the urine had shown no pus. A perineal tear had been immediately repaired. Catheterization was necessary for three weeks thereafter. One week after delivery she began to suffer from "chills and fever." The record states that there was no abdominal tenderness and that the heart and lungs were found normal. She had been under the observation of several physicians, who agreed on a diagnosis of post-partum septic endocarditis. The urine had shown a large amount of pus. Hexamethylenamin, 5 grains, was given every four hours from December 28 until January 17. Blood cultures were negative.

From December 28 until February 1 the temperature had ranged between 103 F. and 105 F., with marked morning remissions, and the pulse from 130 to 140, rather closely following the temperature curve. On February 1 the patient

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was septic in appearance and the mouth dry and foul; the temperature was 103 F. and the pulse 130 and of poor quality. We found no physical signs on which to base even a possible diagnosis of endocarditis. Examination of the abdomen was negative. There was moderate tenderness in both costo-vertebral angles. The bladder urine was acid in reaction and loaded with pus and bacteria. The blood-count showed 18,000 leukocytes, with 18 per cent. of polymorphonuclear cells. The blood cultures were negative.

Cystoscopy showed an intense general cystitis. No. 6 F. olive-tipped catheters passed easily to both renal pelves. The urine from the right side was acid, very turbid, contained a large amount of albumin and showed many epithelia from the convoluted tubules and renal pelves. Pus corpuscles and bacteria were present in abundance. Culture showed colon bacilli and *Staphylococcus aureus*. Their presence could not be ascribed to accidental contamination, for large clumps of cocci and bacilli were present in the fresh sediment of the urine obtained by the ureteral catheter. The urine from the left side was acid, somewhat less turbid but contained the same microscopic elements as that from the right. The colon bacillus was found in pure culture. On completion of the examination 10 c.c. of 10 per cent. argyrol was injected into both renal pelves and the patient kept in the Trendelenburg position for fifteen minutes. This was repeated on February 5, a 2 per cent. solution of argyrol being used. One-half c.c. of Van Cott's mixed vaccine was given on February 3, 7, 10 and 14. Her convalescence was uneventful. On March 1 the pus and bacteria had entirely disappeared from the urine, but the specimen continued to show albumin and occasional hyaline and granular casts and numerous epithelia from the convoluted tubules. At the time of her discharge on March 17 she was clinically cured and the urine showed no abnormalities.

Remarks: We have in this case a patient who had suffered from renal suppuration, mistakenly diagnosed as septic endocarditis. For more than a month the temperature had ranged from 103 F. to 105 F. I am of the opinion that a study of the chart shown in Figure 4 will convince the most skeptical that either the renal instillations, the vaccines, or probably both, had a beneficial influence.

Case 5.—Mrs. M. N., aged 22, housewife, was seen in consultation with Dr. Armin Sibbel on Jan. 1, 1912. Ten years previously she had suffered from acute articular rheumatism and endocarditis. There had been a mitral systolic murmur and hypertrophy of the left ventricle since that time. The

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records showed that on Dec. 6, 1911, there had been an instrumental delivery of a normal child. The perineum had been torn into the rectum, but was immediately repaired and healed *per primam*. Repeated urinalyses made until the delivery had shown no abnormality, with the exception of a faint trace of albumin. Following delivery the urine showed a few pus corpuscles and red blood-cells for several days, but this rapidly cleared up and was attributed to trauma. The temperature, which had been absolutely normal, began to show an evening rise to 99.5 F. The pulse, which had been running between 80 and 90 before delivery, suddenly shot to 130 and ran from 100 to 120 until December 14, the evening pulse-rate being about 20 above the morning. When discharged from the hospital December 23 the temperature was 99.2 F., the pulse 100, repirations 20. She looked and felt perfectly well and the urine showed no abnormality.

On the evening of December 29 she was suddenly seized with a severe chill and lancinating pain in the region of the right kidney. Vomiting and dypsnea were marked features. Dr. Sibbel was called in the morning of December 30 and found the patient suffering from orthopnea and moderate cyanosis. There was marked edema of both legs. The temperature was 102.2 F., pulse 140 and irregular. She complained of a dull pain in the right kidney, the lower pole of which could be felt, and was very tender both anteriorly and in the costo-vertebral angle. Digalen and hexamethylenamin (urotropin) were given.

At 4 p. m. January 1 the cardiac conditions had improved, the pulse having dropped to 110 and being of fair quality, but the temperature was 103.5 F. The patient complained of a dull pain in the region of the right kidney, and there was moderate tenderness in the costovertebral angle. The urine was acid, turbid, and analysis showed a large amount of albumin. There were many epithelia from the convoluted tubules of the kidney and a few blood-casts. Pus corpuscles and red blood corpuscles were present in moderate numbers. Stained smears of the sediment showed bacilli in abundance, which on culture were found to be colon bacilli. Blood culture by Dr. Holzman was negative. The leukocyte count was 12,000, with 88 per cent. polymorphonuclear cells.

Cystoscopy showed no abnormality in the bladder. No. 6 F. catheters passed freely to both renal pelves. The urine from the left side was clear and showed no abnormality. That from the right was turbid and showed the same chemical and cellular features as that from the bladder. The colon bacillus was found in pure culture. Phenolsulphonepthalein appeared on the left side six minutes after hypodermic injection; urea 0.021 per c.c. On the right side the dye appeared in nineteen minutes; urea 0.006 per c.c. Ten c.c. of 20 per cent. solution of argyrol was instilled into both renal pelves and

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the patient kept in the Trendelenburg position for fifteen minutes. A mixed vaccine 0.5 c.c. was given. On the following afternoon her condition was decidedly better, the temperature being 101; pulse 110. Both pain and tenderness were less marked. The vaccine was repeated January 3. January 6 the temperature was normal and the pulse 106. The edema of the legs had entirely disappeared. Renal pain and tenderness had quite subsided. The urine was clear but showed more than a trace of albumin, a few hyaline casts, many epithelia from the convoluted tubules of the kidney and a few pus and blood-cells. Weekly analyses of the urine showed traces of albumin with renal epithelia and an occasional cast for two months after the attack.

Dr. Sibbel reports that with the exception of occasional attacks of cardiac pain with the evidence of temporary failure of compensation, she enjoyed good health.

I was unable to make a further study of the functional capacity of the right kidney, as the patient refused instrumentation.

CASE 6.—The patient, A. D., was first seen on account of chronic urethritis in 1909, when she was 19 years old. She confessed masturbation. The appendix was removed because of constant pain and tenderness over McBurney's point, but with no relief. She was radiographed for renal and ureteral calculi but none were discovered. The pelvis of the kidney was distended with fluid after the method of Kelly and the pain of which she complained was reproduced and exaggerated.

In 1910 her right kidney was explored. It was found to be 4½ inches long, with almost complete atrophy of the cortex of the upper three-quarters. It was removed and she was relieved of the symptoms.

In 1911 she went to the City Hospital for chronic urethritis, and while there had several operations on nose and throat, and a laporotomy for tubal disease. Shortly after this I heard of her as a patient with marked polyuria, the amount being 200 ounces a day.

In August, 1911, I took her in the Post-Graduate Hospital, as she had had retention for five weeks. Catheterization six to eight times daily was necessary, and 20 to 30 ounces were obtained each time. On one occasion she attempted to catheterize herself with a pencil from which the lead had been removed, explaining the act on the ground that she was in discomfort from over distention and could not wait for the nurse. The urine was of low specific gravity, no albumin and the phenolsulphonepthalein elimination was normal. Through suggestion she was relieved.

On Jan. 15, 1912, I saw her again. She told me that two weeks previously she had allowed a girl friend, who wanted to be a nurse, to catheterize her, and that to stiffen a soft rubber catheter she had placed in it a hair-pin. The next day

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the friend confessed that the hair-pin had escaped into the bladder. This was evidently untrue, as the irregularly bent pin which I found with the cystoscope could not have been inserted in the catheter. This pin was finely coated with a white deposit of salts, and the bladder only slightly hyperemic. She did not allow me to remove it.

On Feb. 3, 1912, she called me and reported that the day before she had two chills, fever and pain over the right kidney. The urine contained a large amount of pus, hyaline and granular casts. On February 4, through a Kelly endoscope, I removed the pin. By February 8 the temperature fell to normal, and in a week the patient was discharged. This is not strictly a postoperative renal infection, but is reported as I believe that the pin caused wounds of the bladder mucosa, through which infectious organisms entered the circulation and caused the kidney infection.

On March 1, 1912, she inserted another pin in the bladder which now, May, 1913, shows only slight incrustation—the bladder is only moderately hyperemic. In March, 1913, she broke a needle in her hand.

For the histories of the next two cases I am indebted to Dr. George Gray Ward, through whose courtesy I am able to report them.

CASE 7.—Mrs. G. P. was operated on Aug. 26, 1908, for complete perineal tear and lacerated cervix, sustained in labor six weeks previously. The uterus was punctured accidentally with the curet and had to be repaired through an anterior colpotomy wound.

For the fifteen days following operation she ran a temperature from 99 in the mornings to 101 F. in the afternoons.

For the first nine days after operation it was necessary to catheterize the patient.

September 23, after nine days of normal temperature, with no apparent cause, the temperature was 100 F., and the same the next day. On the morning of September 25 it was 98.6 F., but rose by 4:20 in the afternoon to 103.4 F. September 26 it ran from 103.8 to 106 F., the low points being obtained with alcohol sponges. She began menstruating the next day, and then the temperature began to fall by steps and in four days reached normal, where it remained until October 8, the day preceding her next menstrual period, when it rose to 102.2 F. In two days it was normal and so remained.

She had no pain in the region of the kidneys. There were pus and pus casts in the urine and the colon bacillus was isolated by culture.

Treatment consisted in combating symptoms, and giving large amounts of water and hexamethylenamin. The patient made a good recovery and has since remained well.

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Remarks: The patient was catheterized for nine days and had a rise in temperature for seventeen days after operation, indicating an infection. The late development of the renal condition and the possible association of the menstruation, as shown by two rises of temperature just before menstruation started, are to be noticed.

CASE 8.—Miss J. N., patient of Dr. George Gray Ward, Jr., was operated on, curettage, Gilliam shortening of round ligaments and appendectomy having been performed. She gave a history of two attacks of appendicitis. Catheterized twice after operation. August 31 she complained of painful urination, and on September 2 the bladder was irrigated.

September 3 the temperature rose to 100.6 F. and the next day to 102.8. From the fifth to the ninth it ranged from 99 or 100 in the mornings to 101 F. in the afternoons. On the tenth, coincident with menstruation, there was an accession to 103.8, and 104 the following day. The day afterward the temperature was 101, and in the succeeding days dropped to 99.5. There was an exacerbation on the twentieth to 101.6, and on the twenty-first to 103.6. From then the patient rapidly improved, the temperature came down to 99.5, and so persisted until the time of her discharge on October 1. There was much pus in the urine. At no time was there any pain in the region of the kidneys.

Dr. Ward believes that the renal infection in both these cases was an ascending one.

I am indebted to my brother, Dr. J. N. Furniss of Selma, Ala., for the next case.

CASE 9.—Mrs. T. B. M., resident of Tennessee, was admitted Feb. 20, 1913, suffering with an acute attack of chronic left salpingitis. First attack dates back four years following the birth of a child, at which time she was ill for several weeks with a pelvic inflammation.

Palliative treatment was employed until March 5, when the left tube, which was full of pus, and the appendix, which was bound down by adhesions, with a concretion about the middle, were removed. The patient was catheterized for the first three days after operation. Five days after the operation the patient began to have painful and frequent micturition, with thick, ropy mucus in the urine. This condition cleared up in a few days under bladder irrigations and urethral applications of 20 per cent. argyrol. The general surgical convalescence was excellent, the wound having healed by first intention. March 26 there was rigor and temperature ran to 103 F., with intense pain in the right loin, radiating to the

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right iliac region. The urine contained pus, blood and bacteria and was acid in reaction. The temperature ran from 103 to 100 F. until April 6. Pain and tenderness were incessant during this time. From April 6 to 10 the temperature gradually returned to normal and the patient left the hospital April 28 with negative urine and relief of symptoms. The treatment used was stock colon bacillus vaccine and large doses of hexamethylenamin, 10 grains each four hours.

The report from this patient June 8 was that she was well and still gaining in weight at the rate of 2½ pounds a week since leaving the hospital on April 28.

393 West End Avenue.

ABSTRACT OF DISCUSSION

Dr. J. W. Draper, New York: About eighteen months ago Dr. Braasch and I cut a number of ureterovesical valves in the dog. The reason for doing so was to find out if it were safe to cut this valve in the human being. We had heard so much about the value of this so-called "valve" in preventing ascending infection and bladder reflux that Braasch and others hesitated to cut it. The experiment, briefly, was as follows: After opening the bladder in the dog, it was a simple matter to raise it so that either one or both valves could be cut with a delicate pair of scissors. A cubical piece of anthracite coal was rubbed in the dog's feces and introduced into the bladder, which was then closed. These animals recovered with reaction and lived without any apparent discomfort. They easily held their own with the rest of the pack. They passed what may rightly be called pus in the urine. It answered the clinical description of pus, in that it contained living organisms and immense quantities of leukocytes. The organisms did not penetrate deep into the bladder wall and the animals may, therefore, be said not to have had a true cystitis. We were never able to show that there was any infection whatsoever of the kidneys in these animals, and many of them lived for a number of months. Moreover, hydronephrosis did not occur; the real factor in reflux prevention being the physiologic activity of the ureters rather than the mechanical action of the valve. Since returning to New York I have repeated these experiments and have again been unable to find, either grossly or microscopically, that in this type of experiment on healthy dogs any such thing as ascending infection occurs. Our experimental findings are therefore in exact accord with the clinical studies of Dr. Furniss. The post-mortem studies have been carefully made. The results were reported before the section on genito-urinary diseases in Atlantic City in 1912. These studies led us to consider that it is safe to cut the valves in human beings,

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that ascending infection under these conditions did not occur and that stones lodged in the caudad extremity of the ureter could safely be removed by valve section and without laparotomy. Bleeding may occur, as in a case verbally reported by Dr. Furniss, but it should not be severe. Infecting the bladder in dogs, then, with one or both ureterovesical valves destroyed, will not cause renal infection or degeneration. It should be impressed on us all, nevertheless, that we must be careful in drawing conclusions from the case of the healthy dog and applying them to the sick human being.

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THE MOVABLE KIDNEY

J. H. CARSTENS, M.D.
DETROIT, MICH.

The movable kidney I call any kidney that is movable beyond the physiologic limits. And I see no reason why we should have various degrees, or call it loose or floating, as the symptoms do not depend on the degree of mobility. The kidney that is slightly movable often produces distressing symptoms, while a very loose kidney, the so-called floating kind, produces little or no symptoms, until the patient suddenly discovers that she (as it is generally a woman) has a lump or tumor in her side. Then she consults a physician, who makes the diagnosis, and tells her what the trouble is. Then she finds all kinds of symptoms and distress which probably increases until she is relieved by operation.

CAUSES

A limited number of floating kidneys are caused by injuries such as falling from a chair or a bicycle, or lifting stoves or heavy trunks. Some occur shortly after labor, and it seems that severe labor pains may be the starting point in some cases. The kidney is forced out of its shallow cavity, and gradually the adjustments are stretched more and more until it becomes quit loose. These cases are promptly relieved by operation.

Then we have another variety, in which there is an inherent or acquired general relaxed condition of all the abdominal viscera. These are the most troublesome, as the movable kidney is easily recognized, and the great mistake made by the general practitioner is to attribute all the trouble to the kidney and to overlook the more

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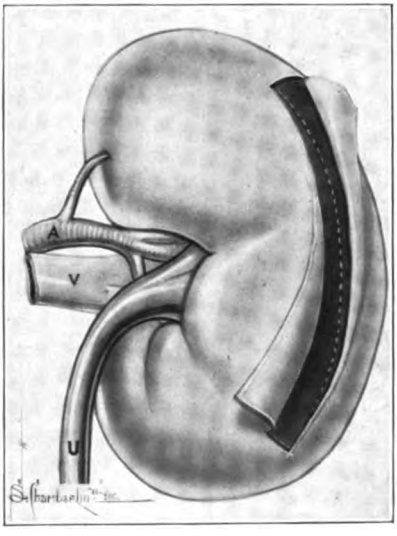

Fig. 1.—Incision of capsule of kidney for flaps.

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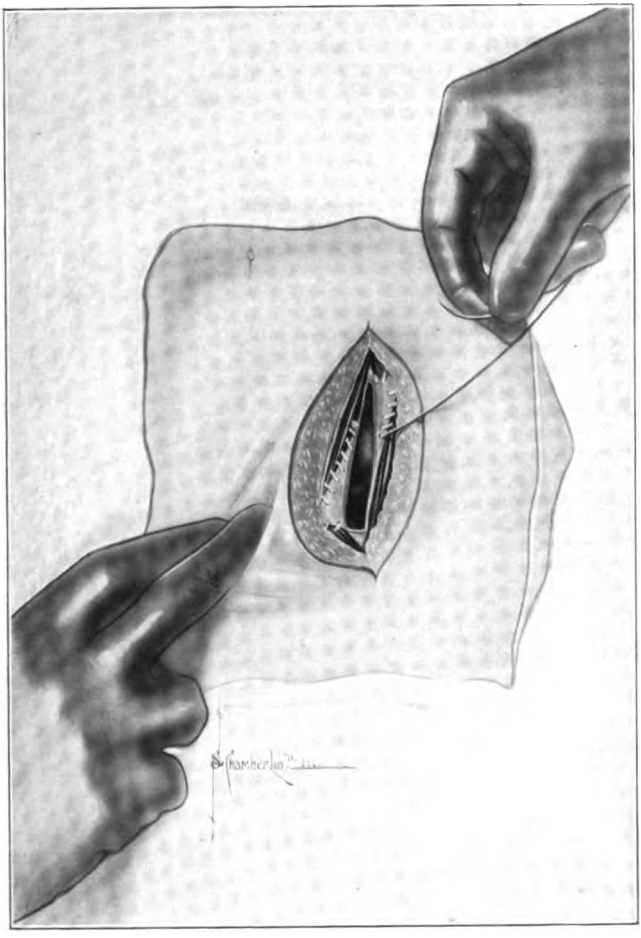

Fig. 2.—Kidney flaps sewed to quadratus lumborum.

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distressing symptoms produced by the general abdominal ptosis. I cannot emphasize this too strongly.

SYMPTOMS

In the majority of cases the movable kidney is on the right side, although sometimes both are movable. The most prominent symptoms, it seems to me, are the pain and distress on the right side with bearing down, especially when walking or doing a little work. It is relieved by lying on the back. The next most frequent symptom in my experience is disturbance of digestion, or flatulency. Any patient in ordinary health otherwise who comes to me complaining of a great deal of trouble with gas I immediately suspect, and make a careful examination for a loose kidney. Sometimes this pain and disturbance is around the sigmoid, and it is often associated with constipation. I could never find any connection between a floating kidney and the production of appendicitis. If the two conditions are found together, there is always general ptosis of all the abdominal viscera. This may cause twisting of the appendix, and interfere with the circulation, thus producing inflammation.

Then there is the severe sharp pain produced by kinking of the ureter, but this is a rare condition. The most frequent and most difficult to make out are the many nervous symptoms produced. Many cases are diagnosticated as hysteria and neurasthenia, while the trouble is really movable kidney, the fixation of which cures the individual, but that does not mean that the two conditions may not exist together.

The digestive symptoms, as well as the various nervous manifestations, I have always attributed to irritation of the solar plexus, on account of the intimate connections of the various organs involved, and the pulling and dragging on the nerves.

In some cases there may be albumin in the urine, and the diagnosis of kidney trouble is made, but the albuminuria disappears after the kidney is fixed. We must

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always bear in mind, however, that there may be real disease of the digestive organs, independent of the movable kidney—real trouble with the appendix with movable kidney, and real nervous diseases with movable kidney. In fact the greatest difficulty is to make an absolutely correct diagnosis, and yet not promise a patient relief and cure, if the physician is not sure of his ground. One of my greatest troubles is to restrain the general practitioner from promising the patient too much, and giving the impression that by a magical, simple operation, I can remove all the symptoms.

TREATMENT

Treatment varies as in any other condition; some people have very little trouble, and need no treatment at all. Others with general abdominal ptosis are often relieved by wearing a belt, not that a belt will keep the kidney in place, as no such belts have been devised. I challenge anybody to hold the kidney in place with the hand, when the patient is coughing or sneezing, and the hand is certainly the best support.

The great principle involved is often overlooked; namely, that the kidney is not an abdominal organ, it is behind the peritoneum, although sometimes it shoves the latter before it, projecting into the abdomen, and thus becoming an abdominal organ.

As in many cases there are no symptoms, conservative members of the profession think that nothing is needed in the way of treatment, which is perfectly true in some cases, but not in all. I think the surgeons are a good deal of the same opinion. Many have had poor success; first, because the patients were not cured even if the kidney was fixed. This was often due to poor diagnosis; the other diseased conditions were not recognized before. Second, the surgical technic has been poor, many have never performed the operation properly, the attachments will stretch and loosen in the course of from three to six months, and the patient is as bad as ever.

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Consequently, two things are necessary in successful treatment: First, the diagnosis must be correct, that is, it must be certain that the symptoms are produced by the loose kidney only; and second, the technic of operation must be such as to fix the kidney permanently in its proper place.

TECHNIC OF OPERATION

We have all gone through the experience of trying to fix the kidney permanently. At first an opening was made at the side, in front of the quadratus lumborum, and *en masse* sutures of silk worm gut used. These were allowed to stay in for two weeks or more with the expectation that the kidney would be firmly fixed, but the adhesions soon stretched, and in the course of a few months the kidney was as loose as ever. Other methods were tried and various kinds of sutures, silk, silver wire and catgut were used. The kidney was retained in place with gauze and held there until granulation formed, and still it would come loose again in time.

The abdomen was opened and the tunnel which the kidney had made for itself, back of the peritoneum, was closed with permanent or absorbable ligatures, by fastening the peritoneum to the muscles of the back. This was of more or less benefit. Strips of muscles were dissected, and pieces of fascia were used to cover the kidney, and fix it in place. In fact, the most fantastic and most complicated operations were devised, all being more or less failures. The fatty capsule was fixed to an incision in the back, but that did not prove useful. The fascia below the kidney, called a ligament by Longyear, was used with benefit.

I did not try all these methods, but I did try most of them, and was soon impressed that as a rule they were of no fixed value. I came to the conclusion that only the fixation by the fibrous capsules could be permanent.

The next thing that I had to settle for myself was how to reach the kidney. At first, I started at the outer edge of the quadratus lumborum, but I found it difficult to

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get the kidney up high enough under the rib, as the corset or the waist band would sometimes squeeze the lower end of the kidney. I then made the incision in the middle of the above muscle, but in looking the anatomy over carefully I finally made the incision in the back, at the junction of the erector spine and quadratus lumborum, from the lower edge of the ribs downward, for two and one-half or three inches. I cut through the skin and fat and with the handle of the knife I separate the muscles. There is almost no bleeding, but few nerves are really injured, they are shoved aside. I cut directly over the space where the kidney ought to be (Fig. 1,)

The usual preparations for operation are made. The patient is anesthetized. I generally use nitrous oxid gas, followed by ether. The patient is placed on the side opposite the point of operation. A sand bag or an air cushion is placed under the waist line or, what is better, a table is used which can be elevated at this point such as is employed in gallstone operations. The part that is to be operated on is thus put on the stretch. The knees are well flexed on the abdomen. The incision is made as described above; one or two fingers are introduced into the retroperitoneal space, and thus one can feel the kidney. If it is very loose it may be shoved into position by the other hand from the abdomen and brought up to the incision. The trouble is to hold it there as I do not take it out. I have tried various devices and found that there was only one way, and that is to catch the kidney in a two-pronged volsellum forceps. I put this into the kidney about one-half inch on each side from the convex border. With my finger I now strip off the fatty capsule, or adherent peritoneum (if any), and thus prevent any dragging by any abdominal organ in the future (Fig. 2).

First making only a short incision, I soon found that the kidney would not be injured if it were denuded extensively of its fibrous covering, so I finally made an incision at the convex border from one pole to the other,

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stripped the capsule off on one side and then made an incision or tear toward the pelvis of the kidney. I then made an incision or tear on the other end near the pole. In fact, the incision would form the letter "z." With a little care one can cut through the capsule only and not injure the kidney; but if the capsule is torn it does no harm, except to cause a little bleeding.

I sew the upper part of the triangle of the loosened fibrous capsule to the erector spina muscle. The other flap I sew to the quadratus lumborum at the lower angle of the wound. The kidney is now fixed where it belongs, that is, at least, as near as I can get it (Fig. 3).

I sew it with No. 3 catgut, plain, not chemicalized in any way. With a running suture I then bring the muscles together. The reflected fibrous capsule of the kidney is thus fastened between the two muscles and firmly fixed.

The skin and fat I do not sew. I take a sponge and dip it in alcohol and wipe the surrounding skin, freeing it of all fat; then with a half-inch wide sterile adhesive plaster strip about one inch long, I bring the skin together accurately. Then I take a long strip of two-inch wide adhesive plaster, start it on the left side just above the umbilicus and draw it tight toward the right and the back, covering the plaster of the incision and going as far as the spinous processes. This is in operation on the right kidney.

I think this plaster acts as a kind of bumper during coughing and straining. This is all the dressing that I apply. I keep the patient in bed about two weeks and take off the plaster, including that which unites the skin and put on another long strip which I allow to remain until it comes off, generally in three or four weeks.

If a so-called stitch abscess should form, I treat it in the usual manner.

To sum up I would say:

1. The movable kidney produces great distress and the most diverse symptoms.

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2. A movable kidney may exist without any other condition as the result of injury.

3. Most frequently a movable kidney coexists with general abdominal ptosis, and requires separate treatment.

4. The movable kidney can only be cured by proper fixation. It is not an abdominal organ.

5. The proper fixation of a kidney will not relieve other independent abnormal conditions.

6. The most careful differential diagnosis must be made, and no relief of other conditions promised.

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ABSTRACT OF DISCUSSION

DR. RUFUS B. HALL, Cincinnati: The most difficult problem in treating the movable kidney was emphasized in the summary of the paper. If we permit ourselves to operate on all the patients who come to us with movable kidney with the hope of relieving or curing them, we shall be disappointed and we shall disgrace surgery. The symptom-complex so frequently seen in the female patient, particularly the patient with movable kidney, is not to be lost sight of. In the larger number of cases of movable kidney the wisest thing for the surgeon to do is to operate. A young surgeon emphasized the situation well the other day, however, when he said that the only reason the large percentage of patients with movable kidney should be operated on was for the fee in it for the surgeon. That puts it pretty strongly, but those of us who have been in the work a long time meet greater disappointments in operations for movable kidney than in all other conditions combined. It is a most difficult thing to say that in a given case you are going to relieve a woman; you cannot do that unless you can differentiate. Unless you can exclude the other conditions and be certain that the symptoms are caused by the kidney you are going to be disappointed. These cases are not always seen in women. I have in mind a distressing case of movable kidney in a young man, 19 or 20 years of age. He was the son of a physician and had the best of attention in the matter of diagnosis and treatment. The roentgenogram showed that he had a stone in the ureter. Then they were sure that it was necessary to fix the kidney. The kidney was cut open, but no stone was found in the ureter. Although the kidney was fixed, none of the patient's symptoms were relieved. The operation was done five or six years ago. The young man has at present all the previous symptoms. You do not relieve the condition by fixing the

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kidney if the kidney is not the disturbing element. Therefore, I say it is most difficult to say that a given case will be relieved. My own experience is that I operate in a great many cases of movable kidney in which I do relieve the symptoms, but in many also in which the symptoms are not relieved.

Dr. Philemon E. Truesdale, Fall River, Mass.: It seems to me that floating kidney is a condition rarely to be treated by surgery. It is usually a part of a general picture, visceroptosis, and to anchor a kidney under such circumstances is a responsibility not likely to prove happy in its outcome. When a patient complains of pain in the side every measure should be employed to determine whether or not there is some other lesion causing this symptom. It seems to me that the operation of suspension of the kidney should be done only on the evidence obtained by the ureteral catheter, irrespective of the mobility of the kidney. Some degree of hydronephrosis is the indication for an operative procedure which will establish proper drainage of the kidney pelvis through the ureter. Whenever called on to operate for movable kidney, I approach the problem with considerable hesitation and decline to operate unless there is positive evidence of back pressure in the kidney pelvis.

Dr. Henry O. Marcy, Boston: In one of our general hospitals a case was under careful observation, diagnosis was made of stone in the kidney and operation followed. The roentgenogram had showed a clearly defined round body that was probably the cause of the trouble. The surgeons failed to find the stone. They called in the roentgenographer to explain the roentgenogram. He said, "I thought, gentlemen, that you knew that was a button on his drawers."

Dr. A. Goldspohn, Chicago: It is true that many displaced kidneys do not cause symptoms; but it is not true that a displaced kidney never causes symptoms. It often does cause symptoms that can be relieved by a correct operation, without opening or draining the pelvis of the kidney at all. The conditions that cause symptoms are (1) the obstruction to the outflow of urine, and (2) obstruction to the return current of blood. A large blue congested kidney constitutes a pathologic condition just as much as passive hyperemia in any other part of the body. The difficult question to answer is, in which cases it does produce symptoms and in which it does not. The degree of displacement does not determine the degree of symptoms; but the degree of fixation of the hilum of the kidney is what chiefly determines the degree of symptoms. If it is so fixed that it cannot descend with the kidney, there will be symptoms from a small degree of displacement. If it can move unobstructed with the kidney, there may be a great descent of the latter without symptoms.

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In determining whether or not to operate I have for some years made it a custom to apply an inelastic rather formidable abdominal bandage with a 3-inch globular compress beneath it, to hold the kidney up for a week or more. After it is determined that the case is not one of general enteroptosis, to correct a displaced kidney the patient is put in the Trendelenburg posture and this inelastic belt is applied around the body with the retentive cushion underneath it and she is told to leave the belt in position without meddling with the safety-pins as long as she possibly can. If that patient has a displaced kidney that causes symptoms she will be benefited by this otherwise uncomfortable bandage. She will leave it in place until she sees you again. This method tests both factors in the disease—the obstruction to the outflow of urine, and the obstruction to the outflow of blood. The roentgenogram shows only the urinary obstruction, but not the feature of the obstruction to the blood current. This ordinary way is therefore really more practical.

I am ready to say that all the methods of technic that deal with the fibrous capsule chiefly are not sufficient, because there is not enough capsule to do any good. The most fruitful suggestion that I know of in this operation was made by Dr. Wyllis Andrews of Chicago. The fatty capsule is not dissected out and thrown away, but is gathered up as a hammock on both sides of the kidney as much as possible, and it is fastened in between the edges of the muscular part of the wound by mattress sutures passed transversely through all, so that the edges of the fatty capsule will be caught between the coapted muscles. These sutures pass through the fibrous capsule of the kidney also, and secure what service that is able to render. The wound can be closed without drainage and heals by primary union. Out of a reasonable number, about twenty cases at least, I do not know of any recurrence of displacement, and I have no observations as to lack of good results so far as function and the patient's comfort are concerned.

Dr. J. H. Carstens, Detroit: These are the kind of patients that need my best services and my best diagnostic ability. All I wished to do was to call attention to the troublesome distress caused by the movable kidney and the neglect of the practitioner to take care of these cases, allowing them to fall into the hands of all kinds of irregulars, just as the surgeon has done with cases of joint trouble. The general practitioner should be aroused to see that movable kidneys cause trouble and can be relieved, and should be taught not to neglect them.

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FURTHER POINTS ON THE STERILITY OF WOMEN

EDWARD REYNOLDS, M.D.
BOSTON

The treatment of sterility has long been one of the comparative failures of gynecology; and one of the most striking points of the case as I have seen them in practice has been the frequency with which women who have been in fact sterile to husbands who are known to have normal spermatozoa have, nevertheless, been pronounced normal even by practitioners of recognized authority. I have, moreover, seen this repeatedly, even when in my opinion a fully adequate cause for sterility was at once apparent in the genitals and when treatment of this condition resulted in prompt fertility. The frequent occurrence of such failures as these must evidently have a reason, which I believe to be that symptoms of ill health of sufficient degree to demand treatment are always dependent on the existence of gross pathologic conditions which we have all long been trained to perceive, but that sterility, on the other hand, is usually dependent on mere perversions of function which are not readily perceptible anatomically, and can therefore be detected only by observation of their results as shown by an altered performance of the daily physiologic functions of the organs.

The use of the terms "gross pathology" and "perverted physiology," though strictly in accordance with modern thought, is so far new in this connection as perhaps to demand a definition of the sense in which they are used. Of course in an ultimate analysis any alteration of func-

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tion is usually due to a variation in the anatomic state of the organ which performs it, but even important functional variations are sometimes so slight as to be unproductive of anatomic variations which are perceptible by the ordinary clinical observations; hence the distinction between a grossly perceptible lesion and one which can readily be appreciated only by its results seems practically helpful, and the expressions "gross pathology" and "perverted physiology" are used here in this sense.

The perversions of physiology which cause sterility in women may be classified under two heads:

1. Conditions of the mucous membranes of the genital tract which may be either small or great in degree, but which even if small lead to alterations of the secretions of these mucous membranes which are destructive to the continued life of the ova or spermatozoa which have been deposited in them, or which annul the effective motility of the spermatozoon in its efforts to reach the ovum.

2. Conditions in the ovaries which inhibit the formation of the ovum or prevent its release at maturity.

A paper which is limited to twenty minutes can evidently attempt no more than a summary of the main features of a large subject, and as I have recently published a much more extended paper on this subject,[1] I propose here to limit myself to such a brief recapitulation of the points there made as may render intelligible some further considerations which were omitted.

THE SECRETIONS

From the time the spermatozoa are deposited in the vagina and the ovum is released from the follicle to the time of their conjugation their only relation to the woman who is their host is that they live in her secretions. The primary condition for fertility is therefore

1. Reynolds, Edward: The Theory and Practice of the Treatment of Sterility in Women, THE JOURNAL A. M. A., Jan. 11, 1913, p. 93.

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that these secretions should be sufficiently normal to permit the continued existence of the sexual elements until their conjugation is effected.

The alterations of the secretions which destroy the life of the spermatozoa, or perhaps of the ova, are of two kinds: (1) changes in the secretions due to pathologic conditions of the mucous membrane which secrete them, and (2) mere fermentative or other chemical changes in the secretion poured forth by a normal mucous membrane.[2]

Either class of changes may be present either with or without detectible gross pathology and consequent symptomatology, but in either case the mechanism which produces sterility is the destruction of the spermatozoa or ovum by a hostile secretion, and it is therefore only by close observation of the secretions that we can determine the cause and consequent treatment of a given sterility. Further, when gross pathologies are present they be no more than indirectly unrelated to the sterility; and their treatment, operative or otherwise, has then no effect on the sterility, unless the conditions which cause this are treated concomitantly.

The genital canal may be anatomically distinguished by the character of its epithelium into four sections, the vagina, cervix, uterus and tubes. The secretions of any one or all of these divisions of the canal may be so altered as to be destructive to the spermatozoa, and may be so altered either chemically or mechanically. The secretion of any one of these divisions may be abnormal without prejudice to the secretions which originate above it, but an alteration of an upper secretion almost necessarily implies a similar abnormality of the secretions below it and into which it is discharged. In the management of a given case the conditions of each of these divisions must be observed separately and often from the necessities of the case seriatim; they should

2. Such a change may, of course, in time react on the condition of the mucous membrane itself.

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consequently be so described; and it further seems conducive to clearness to discuss the conditions of each section first without complicating them by questions of treatment, which may then be taken up by themselves.

The Vagina.—The ideal, normal vaginal secretion is that of the healthy virgin, in whom the vaginal secretion is clear and translucent; barely mucilaginous, and in quantity just sufficient to keep the vagina moist and lubricated, and at the same time to permit of disappearance of the secretion by evaporation as it reaches the surface, without the appearance of moisture in quantity noticeable by the woman.

In the patent vagina, which alone concerns our present subject, the secretion is, however, almost never so absolutely normal as this. The vagina of the virgin may be sterile, but so soon as coitus has become habitual the vaginal secretion always contains bacteria of many kinds, which have normally, however, been decreased in virulence and rendered innocuous to their hostess either by the moderate normal acidity of the secretion or by its other chemical characteristics.

The most common alterations of the vaginal secretion are chemical in the form of overacidity, biologic in the presence of active pus cells, and mechanical in great profuseness. The importance of such hostile conditions of the vaginal secretions is susceptible of experimental demonstration by means of various modifications of normal semen on the field of the microscope and direct observation of the effect of these modifications on the living spermatozoa. The majority of such studies have been concerned with chemical modifications of the semen itself, but there have been in addition a few reports of the effect on the semen of specimens of normal and abnormal vaginal secretions. It has further been occasionally possible to combine the necessary examination of the spermatozoa of the husband with the submission of his spermatozoa to contact with the vaginal

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secretion in question under the microscope, though from the condition of the case the opportunity of so treating fresh spermatozoa will occur but seldom. I had this opportunity once, and although in that case the vaginal secretion was not the only one affected, the prompt disappearance of motion in the spermatozoa as they came into contact with it was quite strong evidence that the existing alteration of the vaginal secretion was in that case quite enough to have caused sterility by itself.

The importance of the vaginal condition must, however, be estimated differently in the nulliparae who form the great majority of the sterility cases and in the multiparae who occasionally consult us for the so-called one-child sterility. In point of fact, conditions which are so common among fertile multiparae as to be evidently normal, and quite inefficient to produce sterility in them, may, nevertheless, be quite efficient causes of sterility in nulliparae. The explanation of this apparent paradox can be made evident by direct observation. In multiparae with lacerated cervices and consequent eversion of a considerable portion of the cervical mucous membrane, it is easy to demonstrate that such a condition as, for instance, the existence of a hyperacidity of the vaginal secretion, is comparatively unimportant. The reaction of the vaginal walls and of the vaginal surfaces of the cervix may in such cases be shown by test paper to be actively acid, while the same paper applied to the cervical mucous membrane when it is thrown into eversion by a speculum will show a neutral or faintly alkaline reaction. With this surface freely exposed to immediate contact with the spermatozoa during the mechanical distention of the vagina in coitus, and remembering that the deposition of only a few spermatozoa on its surface may be sufficient for fertilization, it becomes evident that with such multiparae the hostile condition of the vaginal secretion is of little importance; on the other hand, in a nullipara with the same excessively acid vaginal secretion, but with a pinhole os, the acid reaction of the vaginal surface

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of the cervix, extending, as it does, to the very edge of the os, makes the chance of the entrance of the spermatozoon into the safety of the alkaline reaction before contact with the acid vaginal secretion so extremely small as to constitute practical sterility from the condition of the vaginal secretion alone. The same considerations probably apply with equal force to the other possible alterations of the vaginal secretion, though with them the actual demonstration is less easy than with the mere change of reaction.

The Cervix.—The importance of a differentiation between the condition of the cervix and that of the cavity of the uterine body may seem at first sight doubtful; but the existence of a differentiated cervix and cervical cavity is in its full development peculiar to the human race and forms an element which deserves consideration in all comparisons of the physiology of impregnation as between man and the quadrupeds. The degree to which the affections of the cervix and corpus must be considered separately has only recently been appreciated in the practice of gynecology in general, and in the diagnosis and treatment of sterility this distinction is of much importance. Alteration of the secretions of the cervix without corresponding alteration of the uterine secretions is indeed in my experience by no means an uncommon condition in practice.

The normal mixed secretion of the uterine and cervical cavities is, as it emerges from the os, clear, limpid, translucent and of about the consistency of the white of an absolutely fresh egg. The normal quantity is just that which is sufficient to keep up a constant but almost imperceptible slow flow from the os. Excessive quantity, cloudiness, turbidity and either a mucopurulent or seropurulent appearance are alterations which usually affect both cavities, that is, both the uterine and cervical. Inspissation and stringiness of a portion of the secretion, while the rest remains abundant and substantially normal, is usually an alteration of the cervical condition alone.

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The most common causes of alteration of the cervical secretion alone are retention and consequent inspissation of the secretion behind a pinhole os, in which condition the cervical cavity is frequently considerably dilated, thus forming a retention cavity, hypertrophy of the cervical mucous membrane, often semipolypoid in nature, and localized dilatation of cervical glands, with the resultant escape of small quantities of thick stringy secretion. It is probable that the occurrence of inspissation is usually dependent on contamination of the secretions, at least by some of the bacteria of fermentation.

The Uterine Cavity.—The shape and direction of the cervix and shape and situation of the os are always points of importance, because the extremely common underdevelopment of this portion of the organ usually impose some degree of obstruction to the exit of the uterine secretion, and it is as true in this organ as in other mucous membranes that there can be no complete recovery from chronic inflammation without free drainage. It is only necessary to refer to the experience of the rhinologists in the nose and urologists in the male urethra to recall to your memory the extreme persistence of chronic alterations in secretions behind even partial obstruction. So long as the uterine secretion is thickened, clouded, mucopurulent or seropurulent there will be no pregnancy.[3]

The Fallopian Tubes.—It has not generally been realized that the fallopian tubes have a normal secretion, but they are lined with a mucous membrane and, moreover, with a moist and ciliated epithelium, the cilia of which row toward the uterus; it follows of necessity that there is a tubal secretion in continual drainage through

3. It may be remarked in passing and without entering as yet on the subject of treatment, that for the majority of these conditions the routine expedient of dilatation and curettage is usually totally inefficient to the production of fertility, and the sooner the profession as a whole learns this the better it will be for their patients.

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the uterus. We are ignorant of the nature of this secretion, though it is probable that it is clear, limpid and scanty in amount; we do know that when the tube is infected its fimbriated extremity closes by adhesion and that it becomes distended with an altered secretion, the character of which varies with the individual infection.

Repeated observations in the course of abdominal operations made since I have been especially interested in sterility have convinced me that in addition to these gross salpingites with which everybody is familiar there are many minor alterations of the tubes, chronic congestions, often with thickening, which have not led to closure of the fimbriated extremity, though such would probably follow in time. Just as the distinct salpingites usually follow an endometritis, so these minor alterations of the tubes have seemed to me to be always associated with similar conditions in the uterine body, and from results I have inferred that they tend to disappear with the latter under the influence of complete drainage, in connection, of course, with depletion and other minor treatment. Remembering that the tubes are morphologically merely a portion of the uterus it would, moreover, seem that these things must necessarily be so.

It is to be remembered, however, that the tubes are double and it might be supposed that with one tube normal the condition of the other was comparatively unimportant; but we must also remember the principle already laid down that alteration of an upper secretion always implies alteration of all the secretions below it, and in accordance with this principle there is considerable evidence to show that with one tube normal and the other pathologic, the spermatozoa may be prevented from reaching the secretions of the normal tube by inability to pass through the abnormal secretions of the uterine cavity which are perpetuated by the continued existence of the other (diseased) tube above. When the abnor-

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mality of the tube is slight the diagnosis of such a one-tube sterility is often difficult, but may usually be established with a fair degree of probability by sufficiently careful examination under anesthesia and a comparison of the results of this examination with the tenderness noted without anesthesia and the probabilities derived from the clinical history. Close study of such cases, however, is well worth while, since after proper treatment of the abnormal condition below and the removal of the diseased tube their prognosis is extremely good.

THE OVARIES

The existence of an ovarian infertility has long been accepted as a possible though vague explanation of some otherwise inexplicable sterilities; but descriptions of the actual conditions which produce ovarian infertility and study of the possibilities of remedying it are conspicuously absent from medical literature.

The alterations of the ovaries which are most commonly present in sterility cases are slight to moderate enlargements, caused either by the presence of numerous small to medium-sized retention cysts, or by the presence of unduly large, persistent and frequently cystic corpora lutea.

Multiple retention cysts may be distinguished from the normal presence of one(or very occasionally more than one) mature normal follicle by their persistence, undue size or large number. They are usually accompanied by undue thickness of the capsule and are usually bilateral.[4] They are familiar objects to every abdominal surgeon. They are not usually considered of importance. In the course of a long series of conservative operations on enlarged ovaries for other reasons their relation to sterility had not occurred to me until a review of all my cases of conservative surgery of the ovaries led me to notice the considerable frequency with which this work

4. When strictly unilateral, they are probably not necessarily causative of sterility.

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was followed by pregnancy in women who had previously been sterile for a number of years. Since then I have watched this point in every case in which I have opened the abdomen and have seen but one case of bilateral enlargement of the ovaries by multiple retention cysts in a fertile woman. The addition of the conservative surgery of the ovaries to my armamentarium for the relief of sterility in carefully selected cases naturally succeeded and was at once followed by a marked increase in the list of successes.

The assertion that bilateral enlargement of the ovaries by multiple retention cysts bears a causative relation to sterility is at present incapable of either proof or disproof other than by clinical results, the histologic evidence which I had hoped by this time to be able to bring forward having been interrupted by the accidental destruction of a considerable number of specimens which had been carefully preserved for this purpose. I hope in the future to be able to produce such histologic evidence in proof or disproof of my present belief.

The importance of persistent corpora lutea as a cause of sterility is more easily established. Even the possibility of the existence of a pathologically persistent corpus luteum in the human ovary is a somewhat new suggestion, though scattered reports of such cases have appeared from time to time for many years;[5] but it is a quite common surgical experience in the resection of ovaries to find apparently unduly large, and sometimes even cystic corpora in ovaries, some of which have been known to be enlarged for many months, or even years; and the whole trend of modern study warrants the view which some of the best authorities affirm as positively established that the presence of a corpus in the ovaries inhibits further ovulation. There is, moreover, interesting clinical evidence of their importance. Among my records of sterilities which have been successfully treated

5. Hirst, B. C.: The Corpus Luteum of Pregnancy in Non-Pregnant Women, Med. News, April 5, 1890.

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I find three cases in which a stationary enlargement of one ovary had been noted from periods of several months and in which the enlargement of the ovary was found at operation to be caused by a large and more or less cystic corpus. I find four other cases in which a similar condition was found at operation but in which the patient had been under observation for but a short time before the operation was undertaken. In each of these seven cases the enlarged and apparently persistent corpus was removed from the ovary and its bed closed over, and in every one of the seven cases the operation was followed by the prompt appearance of pregnancy in a previously sterile woman. Further, a similar though less surgical method of removing the persistent corpus has been classical among veterinary surgeons in the treatment of sterile cows for many years and is stated to be very successful.[6]

The subject of the differential diagnosis between these several forms of moderate enlargement of the ovaries is one which I have been for some time studying and which I hope can yet be rendered probable by the differential symptomatology, but on which I am not yet ready to speak. It is of practical interest in connection with both of these alterations of the ovaries that they are seldom if ever seen in cases which are wholly free from alterations in the lower portions of the genital tract. I have so far seen no such case. It follows that the routine submission of sterile women to abdominal section without careful, exhaustive study of the other conditions is totally unjustifiable and would result in much unnecessary operating. The case as a whole must be carefully investigated first; even then the propriety of instituting an abdominal operation for sterility alone must rest on the conditions of the individual case. It is probably justifiable only when considerations connected with the health of the patient warrant a section independently,

6. Williams, W. L.: Veterinary Obstetrics, Including the Diseases of Breeding Animals, Ithaca, 1909.

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or in carefully selected cases after the lower alterations from the normal have been remedied by treatment without avail, and when the intense desire of the patient and her husband for children renders them fully ready to assent. It should certainly not be attempted for sterility alone by the unskilled operator.

METHODS OF TREATMENT

A complete discussion of the technical details of the treatment which has been found in my experience the most successful in the management of sterility dependent on (*a*) alterations of the secretions, or (*b*) ovarian alteration, would form a complicated subject which would necessarily run into great length; moreover, so much of the choice of detail is as yet necessarily empirical, that it would be difficult to put it on paper in clear form. The general principles which govern it can, however, be so stated. Their application to an individual case must be governed by experience as influenced by study of that case.

Treatment of the Altered Vaginal Secretions.—The alterations of the vaginal secretion are apparently always due to infection, with the exception of profuseness which is usually the result of a general pelvic congestion or of those hyperacidoses which are a part of general constitutional hyperacidosis. Treatment naturally follows along the lines indicated by these three etiologies.

The cause of a pelvic congestion must be ascertained and remedied. The treatment of congestions due to general circulatory conditions or to the presence of gross pathology in the pelvic organs need not be further referred to here. It falls into the domain of the textbooks, and I need only say that such conditions must be remedied before the treatment of sterility proper can be undertaken. In the absence of these or other evident explanations of congestion the past sexual and the present marital history must be carefully taken and cross-examined. Many of the minor perversions of the sexual

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habits are in extremely common, though usually innocent use even in married life, and furnish abundant reason for the existence of a habitual congestion. Nothing can usually be effected in the treatment of sterility until such habits have been remedied.

General hyperacidosis demands the appropriate general medical treatment.

The results of infection vary in accordance with the bacteriology from mere fermentations of the secretion up to the gross pathologic conditions. Extreme hyperacidosis of the vaginal secretion only is a not uncommon phenomenon and is usually due to the presence of an excessive number of acid-producing bacteria. It is like most of the other alterations of the vaginal secretion technically an infection, and like most of them is to be met by thorough disinfection. This may no doubt be accomplished in many ways. My own preference for effective and rapid disinfection of the vagina is to place the patient in the knee-chest position with the perineum raised by a short Sims speculum and cover the entire vagina thickly with powdered protargol introduced through a powder blower, after which a little dry cotton is placed within it for reasons of comfort. If thoroughly done this results in the discharge within a few days of a cast of the vagina formed partly of inspissated secretion and partly of the superficial epithelium. If such a case is not obtained the treatment has been ineffectively carried out. This treatment is attended by no discomfort or soreness, it may be repeated as many times as desired, and yields an exceedingly normal-looking vagina. When the sterility has been dependent on the existence of a hostile vaginal secretion with normal secretions above, this treatment is usually sufficient for a cure; but when the altered condition of the vaginal secretions is dependent on the constant drainage into them of an abnormal secretion from above no permanent improvement can be expected until the upper abnormalities have been remedied.

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The Cervical Secretion.—When the vaginal secretion has been disposed of the condition of the cervix must be investigated. This should be carried out first by simple observation of the character of the cervical secretion, and of its quantity as observed for a considerable length of time through a speculum, and by expression of the retained cervical secretion by compression of the cervix; and next by examination of the shape and dimensions of the cervical cavity with a sound and by hooking out any thickened secretion from along its walls with the sound or wire loop. . . .

Treatment of the abnormal conditions found must depend on their nature and may include the ordinary topical applications and perhaps curettage of the cervical cavity, but should always include the establishment of entirely complete drainage of the cervical cavity.

If in the presence of retained and altered cervical secretion the external os is in any degree smaller than the cervical cavity above it, it is essential that this constriction should be done away with before any topical treatment can be expected to be effective. For this purpose divulsion or mere division with the scissors is thoroughly ineffective, being at the best only temporary in its results. A Pozzi operation or a similarly executed posterior discission is necessary to satisfactory results in the great majority of such cases. Plastics of this kind may of course be done alone or as a part of a more extended operation; but when there is distinct alteration of the endocervical mucous membrane they must usually be followed by efficient operative or topical treatment of that mucous membrane if they are to be effective.

The Uterine Secretion.—The only two methods of treatment of the uterine mucous membrane which need be mentioned are curettage and disinfection, and for safety and effectiveness both of these are dependent on the coincident institution of free uterine drainage. No disinfection of the uterine cavity is safe unless it is done in the presence of the complete distention and free drain-

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age which is usually attained only after an operative opening of the canal; it is then harmless. Curettage is usually also necessary whenever the uterine mucous membrane is the seat of definite alterations; but no one who has had the experience of removing uteri which have just been curetted can have failed to be impressed with great skepticism as to the results of curettage as ordinarily performed. When a uterus is so inspected it is surprising to see how much of the mucous membrane has been left untouched even by a very careful curettage, and it is, I believe, usually impossible to perform even an approximately thorough curettage without the use of several curets, or of one which can be adapted to every part of the uterine cavity. It is my habit to use one large curet bent so as to readily sweep the posterior wall, a second large curet adapted to the anterior wall and a very small-bladed flexible curet which can be bent and rebent for curettage of the cornua and fundus and lateral walls. Even after such a curettage as this there are apt to be islands and stripes of untouched membrane, as I have once or twice had occasion to know from inspection of my own work when a hysterectomy has unexpectedly become necessary immediately after the performance of the curettage. These islands and stripes of abnormal mucous membrane will surely lead to reinfection of the whole cavity unless the curettage is supplemented by the establishment of the tendency toward recovery which follows the establishment of permament free drainage.

Such permanent free drainage is almost never effected by mere dilatation. It can be established only by careful study of the causes of defective drainage in the individual case and the adoption of appropriate plastic work to remedy its cause. Successful determination of these abnormalities often demands very close study; for instance, careful exploration of the region of the internal os after the cervix has been opened by a discission, with a sound which has had the extreme tip bent to an acute angle, often reveals unexpected angulations of the canal,

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or the existence of bars or prominences in the mucous membrane on the anterior or posterior wall, or both. These phenomena are quite preventive of free drainage and furnish the best of reasons for the persistence of abnormal secretions, yet they are quite unknown to those who merely practice dilatation of the os. All of these conditions are most frequent when the cervix is in anteflexion and underdeveloped. These conditions may demand bilateral division of the cervix and its subsequent repair, the posterior discission and release of forward fixation of the cervix which I have described,[7] or other plastics, or even operations from above; the choice must be left to the plastic sense of the individual surgeon.

After the performance of any of these plastics the uterus should be curetted and the curettage should usually be supplemented by thorough, deep disinfection of the uterine mucous membrane as a part of the operation, and while the canal is still in acute operative distention and consequently under freer drainage than it will have at any other time.

Tubal Sterilities.—The tubes and ovaries are not appropriate for minor treatment other than as the drainage and disinfection of the uterine cavity may usually be relied on as aids to the subsidence of the minor tubal alterations described before, and as the institution of permanent free drainage from the uterus may often be depended on to relieve the minor abnormalities of both the tubes and ovaries. Both of these organs if directly attacked at all must be attacked by major operations; and as the technic of their reparative surgery is again a subject which must be left to the plastic instinct of the individual operator, which is extensive, and on which I have given my views elsewhere,[8] I shall omit further reference to it here.

7. Reynolds, Edward: Anteflexion of the Cervix and Spasm of the Uterine Ligaments in Relation to Retroversion, Dysmenorrhea and Sterility, Surg., Gynec. and Obst., July, 1911, p. 17.
8. Reynolds, Edward: The Ultimate Results of the Conservative Surgery of the Ovaries, Surg., Gynec. and Obst., March, 1912, p. 255.

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At the bottom of the whole subject of treatment lies the principle that even the ovarian infertilities are almost invariably associated with physiologically obstructive conditions in the genital canal, minor or major, and that the patency of a canal is only the patency of its most obstructed point; moreover, it must be remembered that I am speaking here not of that simple phenomenon, mere mechanical patency, but of that much more complicated and delicate matter, the physiologic patency, which permits the passage of a living ovum and of a living and actively motile spermatozoon to their point of conjugation, and finally to the implantation of a fertilized ovum. Perhaps the most important and certainly the most generally overlooked point in the whole subject is that the destruction of this delicate physiologic patency is frequently effected by alterations which are so minute in degree or limited in area as to escape diagnosis under merely routine observation.

The work of Stone of Washington[9] in treating infected tubes by the forcible injection of tincture of iodin through the cervix into the tubes, and even into the pelvic cavity as a preliminary to an abdominal incision for salpingitis is of much interest, but has not as yet been used frequently enough to demonstrate its entire safety. In a number of cases I have used similar injections of tincture of iodin made in the reverse course, that is, injected from the fimbriated end of the tube with sufficient force to drive them through into the vagina, and am so far inclined to believe that this will prove a valuable addition to our conservative operative work on the tubes in a certain proportion of cases, but have not as yet had a sufficiently large experience to speak with certainty of it.

Accurate, minutely accurate, diagnosis; the limitation of treatment to the areas affected without unnecessary invasions of normal structures above the affected areas;

9. Stone, I. S.: The Conservative Treatment of Salpingitis by Uterine and Tubal Injection, THE JOURNAL A. M. A., March 1, 1913, p. 656.

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the attainment of complete drainage by appropriately planned and executed plastic work in combination with deep mechanical or disinfective treatment of the affected areas and of them only; and the recognition and treatment of ovarian infertility, when it exists, are the essential principles in accordance with which all the details must be planned.

The treatment of sterility is frequently operative and as such demands operative skill and readiness to assume a not infrequently considerable operative responsibility; but it also involves a minuteness of diagnosis and a patience in treatment which must be exercised sometimes before operation, sometimes independently of operation, sometimes after operation. These facts in connection with the exquisite balance which is necessary to the continued life of the spermatozoon and ovum within the genitals; to success in their search for each other, and to that conjugation and attachment to the decidua which means fertility, all combine to render this subject an intricate one, and to make its treatment one which is almost a specialty within a specialty; moreover, much more study is needed before its details can be placed within the category of accepted text-book knowledge, but that with patience, intelligence, and minute observation, treatment may be made satisfactory and successful is already assured.

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Frank, R. T.: The Function of the Ovary, Surg., Gynec. and Obst., July, 1911.

ABSTRACT OF DISCUSSION

DR. ROBERT T. FRANK, New York: Dr. Reynolds has modified our conception of the factors which enter into the production of sterility largely because he has not limited himself to the usual course of study in this subject. He has not confined his attention to the gross mechanical lesions, but has concentrated his efforts in trying to elucidate the "physiologic perversions," as he happily terms them. Dr. Reynolds apparently lays a great deal of stress on the external secretions of the genital tract. Perhaps he is right. The factors which enter into the production of these sterilities are so complex that it is necessary to divide sterility into several classes. I agree with Dr. Reynolds that gross mechanical lesions play a subsidiary rôle. This is shown by the frequency of conception in the presence of vaginal septa and in the presence of fibroids, some of them obstructing the uterine canal. This is shown by conceptions even in the presence of every obstacle that Nature or art can place in its way. Conception has been reported through a vesicovaginal uterine fistula. In my opinion the condition of disturbed function, on which Dr. Reynolds laid so much stress, is really the factor we must study in order to advance in our treatment of sterility. The uterus is often at fault, but not as was formerly considered, not from an inflammatory lesion or chronic endometritis, for instance. In order that conception may successfully take place it is necessary that the ova grow up, ripen and be expelled and received into the tube. Then the corpus luteum must form in the ruptured follicle. Unless this last has occurred the uterine mucous membrane will not be sensitized for the reception of the ovum. This sensitization is necessary in order that the ovum may take root. The corpus luteum is the factor that produces this reaction. Dr. Reynolds, therefore, justly laid great stress

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on the persistence of the corpus luteum, because a persistent corpus luteum, among animals, has been shown to cause sterility by preventing further growth of all ova which have attained a good size in the ovary. Unfortunately, I think that in the human being we cannot consider the matter so simple as this, for, were the persistent corpus luteum a regular cause of sterility, these cases should always be accompanied by amenorrhea, which is by no means the case. The problem is therefore extremely complicated. The most necessary thing for us to determine, either through animal experimentation or from human observation, is in what case the condition of sterility is due to the uterus, in what case due to the ovary, and particularly whether or not menstruation and ovulation coincide. In this last matter, which has been so long sought for by gynecologists, lies the crux of the question.

DR. LAURA BRANSON, Iowa City, Iowa: I have long been interested in the subject of sterility of women, particularly in that form dependent on ovarian conditions. I was much pleased to hear Dr. Reynolds point out the possibility of the ovary having much to do with the condition of sterility. There is but little literature on this subject. In an April number of THE JOURNAL a report gives the following conclusions from a biologic point of view: (1) In vertebrates, the female possesses all sex qualities; (2) The habitat of these sex qualities in the ovary; (3) These sex qualities are developed by the internal ovarian secretion. The biologic conclusions also point to the fact that the ovum is developed by this internal ovarian secretion and that it inhibits or prohibits the menstrual function. Right along this line, let me say that I am more than pleased at the conservative manner in which surgery of the ovaries is at present conducted, because now while biology and physiology are pointing in the direction of study of the ovaries we shall have material left *in situ* on which to base these investigations and experimentations, whereas a few years ago ovaries were removed which might have been saved to perform the functions for which they were intended.

DR. CHARLES S. BACON, Chicago: There is one feature of this subject which I think may be mentioned—the influence of the corpus luteum in sensitizing the decidua. This might possibly furnish a clue to treatment. One might use the products of the luteal body of animals or the corpus sensitized from the uterus. I have employed it in some instances in which, apparently, I obtained results. This gives us something for further study.

In addition, there is the question, How often do we have, not a very early abortion, but an incomplete nidation, resulting in an abortion? This, of course, is part of the sterility problem, and here also the early abortion may be due to the lack of the corpus luteum secretion. Here, too, possibly there may be some help from the early diagnosis of pregnancy. The

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diagnosis is most important in women who have irregular menstruation. It is of the utmost importance to determine whether we have to do with early abortion. If the newer methods of diagnosis will help us in this, they will help in solving a practical problem.

DR. J. H. JACOBSON, Toledo, Ohio: We must be certain that there are no mechanical disturbances present before we suspect that the secretions are at fault. In short, we must demonstrate positively that there is a patent genital canal extending from the Graafian follicle to the vulva. If you will recall the anatomy of the fallopian tube, you will remember the differences in structure of the tube at its inner and outer end. The lumen at the outer end of the tube is large and there is comparatively little muscular tissue; at the inner end of the tube there is much wall and practically no lumen. The patency of the inner end of the tube is difficult to determine, and it is this particular part of the genital tract that I believe is often the seat of obstruction, the result of inflammatory changes at this point. For some time past, from specimens removed at operation, we have tried to determine the patency of the uterine end of the fallopian tube. We have found that in most cases in which there has been a previous salpingitis, even though of mild character, we could hardly ever get injected fluid through into the uterine cavity. I feel that in the surgical treatment of sterility this form of obstruction is probably the most important lesion to determine. The operation of hysterotomy, as advocated by Deaver, will find a field of application for this class of patients.

DR. EDWIN REYNOLDS, Boston: Dr. Jacobson brings out a point. We are dealing with something more than a question of mechanical patency. We are dealing with a question of a very delicate physiologic patency. Just as the strength of a chain is the strength of its weakest link, so the patency of a canal is the patency of its most obstructed portion. Now, the point which I wish especially to drive home, if I can, is that, while it is ridiculous to say that there is anything short of an absolute obstruction which can prevent the passage of the ovum, nevertheless, if there is a relative mechanical obstacle, a lack of mechanical patency, there will be a lack of physiologic patency from the inspissated, thickened and altered secretions behind that mechanical impatency, or partial impatency.

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PROLAPSE OF THE UTERUS

FRANKLIN H. MARTIN, M.D.
CHICAGO

We were taught: "Keep the cervix of the uterus in the hollow of the sacrum and the rest of the organ will take care of itself."

This teaching is just as applicable now for prolapse of the uterus in the modern treatment of that condition as it was found for all kinds of displacements of the uterus, when these conditions were treated by pessaries and multitudes of "methods" of surgery.

The most modern and satisfactory operation for extreme descent of the uterus is undoubtedly the Dührssen–Watkins–Wertheim anterior transposition operation. This involves the placing of the fundus beneath the bladder and making a high restoration of the rectovaginal septum. This throws the uterus into extreme anteversion and places its fundus below the bladder—between it and the anterior vaginal wall. This, of necessity, turns the cervix backward and with a fulcrum of the highly restored levator ani muscles to act beneath it, it is still further shunted higher into the hollow of the sacrum with each attempt of the fundus to descend. This position of the uterus blocks the passage and the twisted broad ligaments shorten the central support and the hernia is cured by changing the presenting diameter of its contents.

This operation is ideal in women past the childbearing period. In extreme cases, it is doubtful if one would not be justified in rendering the woman sterile by interrupting the tubes, in order to make the opera-

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tion available for prolapse in child-bearing women. This I have done.

Recently, on several occasions, I have modified the steps of the Watkins operation to make it available to younger women.

In the first step of the old operation, after making the longitudinal incision through the anterior vaginal wall in order to elevate the bladder and to expose the fundus for delivery, there are always observed two strong fascial bands extending from the pubis beneath the lateral walls of the vaginal mucous membrane, which extend to the cervix. They are the stretched-out remains of the pubocervical or the vesical uterine ligaments. The prolapsing bladder has descended between them. By a rapid dissection these fascial bands can be separated from the lateral walls of the vagina and their outer edges will be found to coalesce with the strong middle diaphragm or fascia of the pelvis.

In the operations I have done, after these fascial bands are dissected free, the bladder is carefully elevated to a level of the top of the fundus of the uterus. The cervical ends of these bands are severed, appropriately shortened on their cervical ends, and after being crossed in order to make a support for the bladder, the ends are securely transplanted into the fundus of the uterus just in front of the crest. The vaginal wall is closed, after its superabundance is removed, in a manner to maintain or increase its long diameter, and to eliminate the dead space caused by elevating the bladder.

Previous to this step, the fundus has been exposed, and when the case of prolapse has been a severe one, and the fundus is easily delivered, I examine by inspection, by means of a broad long-bladed retractor placed above the delivered uterus, the sacral folds of peritoneum containing the vestige of the sacro-uterine ligaments. These folds are often easily seen and felt, appearing as long flaccid folds of peritoneum. A pair of rounded, slightly curved, 8-inch artery clamps, guided

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by sight and touch, are thrust through the base of each broad ligament, on a level of the internal os and from a point in front of the cervix from within the longitudinal vaginal incision, into the culdesac of Douglas. The forceps are then opened in order to enlarge the tunnel through which they pass, and they are each made to grasp the sacro-uterine fold at a point about one-third distance from its uterine end, and this fold is drawn through the route of the forceps on either side of the cervix, while the cervix is pushed upward and backward on the doubled peritoneal fold until the forceps have withdrawn the apices of the two folds to the point of the cervix. The cervix is pushed well back on these folds after the grasp of the forceps is renewed. This not only carries it backward, but upward. The folds of the superabundance of ligament are then securely united in front of the cervix. The appendages of the uterus are inspected and the fundus fixed, as heretofore described.

With this form of operation, a successful result depends much on the form of the perineorrhaphy.

In prolapse cases it is often forgotten that the posterior vaginal wall mucous membrane becomes atrophied in its longitudinal direction. An attempt to restore the cervix to its high position in the hollow of the sacrum will reveal a distinct pull on the cervix on the part of this atrophied vaginal wall. This pull may prove diastrous to the stability of the replaced uterus.

In these same cases, too, the levator ani muscles are defective in effecting their normal support, either because of being torn, because of an undeveloped condition, or because of being displaced laterally by the forces of childbirth. In each of these cases, the anus is unsupported and sags below the normal level, and the lower rectum pushes forward the vaginal mucous membrane in a rectocele.

The perineorrhaphy that I attempt to do in these cases effectually corrects these conditions; that is, it

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lengthens the posterior vaginal wall and takes the pull off the cervix; it brings together the defective levator ani muscles between the reconstructed vaginal wall and the rectum; it elevates the anus and obliterates the rectocele by elevating the end of the lower bowel; it places the reconstructed levator ani muscles directly beneath the elevated cervix, and thus gives it no opportunity to begin a descent.

I received the idea of this operation in witnessing a somewhat similar procedure at the Mayo Clinic. In its essentials, it is a flap-splitting operation. In detail, with its modifications as I perform it, it is as follows:

The ordinary horseshoe incision is made, extending to the side of the vulva and across the septum between the vagina and anus. The portion of the mucous membrane at the center of the septum is separated from the rectum for about one inch; the remainder of it is allowed to retain its attachment. Then a high dissection is made on either side of the vagina and the vaginal rectal space until the levator ani muscles are definitely exposed. The vaginal mucous membrane flap is now grasped at its middle point with a long pair of forceps, and the free straight border of the vaginal flap is converted into an acute triangle with the central portion grasped by the forceps as the apex and the two sides of the triangle extended longitudinally into the vagina by carrying the portion grasped by the forceps in a direction away from the perineum toward the cervix and the vault of the vagina. This maneuver elevates the lower end of the rectum by the pull on the centrally attached mucous membrane of the vagina and allows the levator ani muscles to be brought together in the central line beneath the elevated rectocele and the extended posterior wall of the vagina. The two sides of the angle of the mucous membrane of the vagina are now united in the middle line, making a seam extending from the new vaginal edge to the elevated tip of the vaginal mucous membrane which con-

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stituted the apex of the triangle. The skin over the perineum is next closed by extending the simple catgut suture which closed the longitudinal line in the posterior vaginal wall.

When this operation is done for prolapse, I avoid, whenever it is possible, amputation of the cervix, as I desire to have that projecting portion of the uterus riding well back of the reconstructed perineum to aid in preventing the uterus paralleling the vagina.

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VAGINO-UTERINE PROLAPSE AND ITS EFFECTIVE TREATMENT

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Vagino-uterine prolapse is a form of hernia through the vaginal outlet which may involve respectively the bladder and anterior vaginal wall, the anterior vaginal wall or the bladder and the cervix uteri; or the eversion may comprise cervix, or uterus, and the entire vaginal structure. The protrusion of the anterior pelvic segment is frequently a sliding of the bladder, pushing it before the anterior vaginal wall and dragging on the cervix where the uterus is firmly fixed as by firm ligaments and resistant peritoneum. The traction on the cervix causes a hypertrophic elongation of the supravaginal portion of the cervix. The anterior and posterior vaginal walls are attached to the cervix at different levels so that such an elongation may occur in the vesical portion of the cervix with complete eversion of the anterior vaginal wall and the cervix, while the posterior vaginal remains intact and presents its normal length. Not infrequently the hernia begins in the posterior wall as a protrusion of the rectum between the levatores ani by which the vagina is protruded or sacculated. Traction is made on the cervix which may lead to hypertrophic elongation, or to displacement of the entire uterus (Fig. 1). Not infrequently, also, the protruding rectum becomes adherent to the edges of the levatores ani and must be separated in order to permit the introduction of sutures for the interposition of the muscles. The prolonged continuance of this form of hernia leads to

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passive congestion, edema and thickening of the walls. The congested structures have decreased resistance and are exposed to more frequent injury through contact with the patient's clothing, friction against her limbs, soiling with urine and feces and other injuries. Patches of ulceration are frequent and when formed are slow to heal; the uterus is heavy, enlarged and sometimes irreducible; more frequently, however, the traction of the thickened tissues causes elongation of the supravaginal portion of the cervix while the body retains somewhat near its normal situation. In the great majority of cases, this condition occurs in women advanced in life, nearing or having passed the climacteric. In such patients the problem of subsequent gestation is not an essential factor, but even in women during the childbearing period any operation for the successful retention of the protruding uterus and vagina is inconsistent with the continuance of procreation. No operative procedure has been devised for such a condition which will successfully endure the mechanism of a subsequent labor. Indeed, the changes produced in the uterus are such as to render conception improbable, and to make the uterus unable to develop in such a way as to offer a reasonable probability that the fecundated ovum shall find a proper soil and secure habitation to ensure completion of the pregnancy. When it is probable procreation will not be successful, there should be no hesitation as to the removal of the uterus. It is difficult to restore a uterus which has undergone elongation of its cervical portion to the proper relation with the other pelvic structures. It is a more or less crippled organ, capable of adding to the unhappiness of the situation.

It is well appreciated that the discomfort and danger to the patient is lessened when the operative procedure can be confined to the vaginal route. The uterus in such cases is a needless organ—yea, worse than needless, a diseased organ—which affords lessened discomfort especially through its removal by the vaginal procedure; the

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more rapid convalescence and the greater security for permanent recovery are ample reasons for resort to this procedure.

The operation is commenced by the removal of a large section of the anterior vaginal wall; the bladder is widely pushed back from the retained portions, and separated from the cervix until the peritoneum is reached and opened. The posterior peritoneum is opened and the uterine and ovarian vessels ligated on either side, the broad ligament stumps held with clamp forceps and the uterus removed. In such cases, the retroperitoneal pouch has dissected downward covering an unusual portion of the anterior rectal surface and dragging down the rectum.

The peritoneum should be stripped off from the prolapsed rectum; when the hemostasis is complete, the recumbent patient should have the pelvis slightly elevated until the intestines slide out of the wound. A suture enters the anterior border of the left broad ligament, gathers up the peritoneum of the bladder, is brought out through the anterior margin of the right broad ligament, when its ends are secured by clamp forceps. A second suture passes through the posterior margin of the ligament and gathers up the peritoneum of the pouch of Douglas which we separated (Fig. 2). A third suture passes beneath the peritoneum of the upper surface of the left ligament, is carried through the wall of the bladder midway between the peritoneal reflexion and the vesical neck (lower if required), emerges from the right broad ligament in a similar manner to its entrance on the left. A fourth suture from the upper surface of the one ligament stump passes through the wall of the rectum from which the peritoneum has been stripped and out through the opposite ligament; each of these sutures has been secured by forceps, perferably by forceps of different sizes so that they can be easily differentiated. The tying of the first two sutures closes the peritoneal cavity. The remaining sutures when secured

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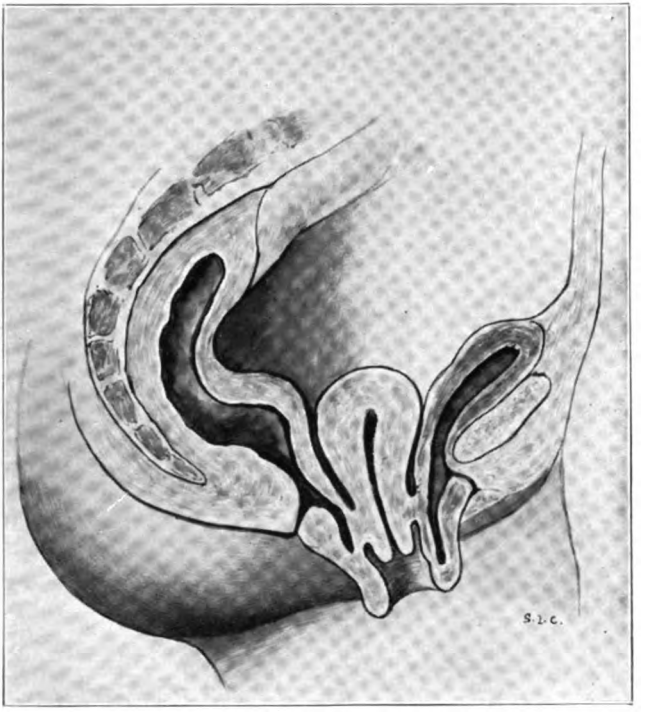

Fig. 1.—Vagino-uterine prolapse.

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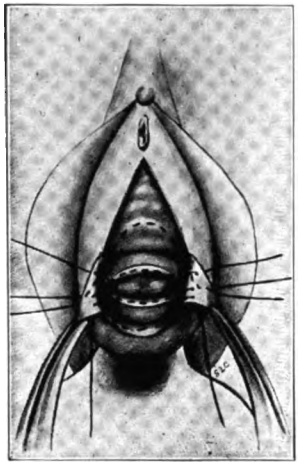

Fig. 2.—Sutures inserted for closing the peritoneum and lifting up the bladder and rectum.

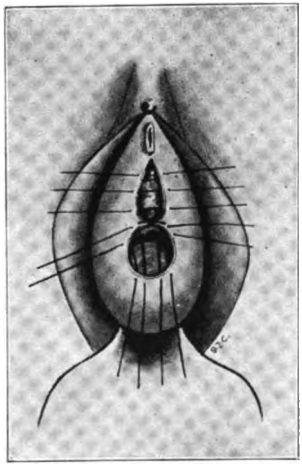

Fig. 3.—Broad ligaments overlapping beneath bladder and rectum. Sutures inserted to close the vaginal walls.

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raise the prolapsing bladder and rectum. The stumps of the broad ligaments are made to overlap each other and the bladder and rectum are secured on their upper surfaces and beneath the peritoneum (Fig. 3). The anterior vaginal sections are secured to the broad ligament stumps and are closed over the bladder by transverse interrupted sutures. Each suture picks up the muscle wall of the bladder, thus obliterating dead space. A pledget of iodoform gauze is packed into the pelvis.

The operation is completed by dissecting a flap from the vulvovaginal margin upward on the posterior vaginal wall, largely by blunt dissection or pressing the tissue away from the vaginal flap with a gauze sponge until a suitable height has been reached, when a triangular portion of this mucous flap is excised. The sutures are so introduced into the edge of the levator ani muscle as to bring the structure from one side in apposition with its fellow in front of the rectum. When thus secured by three or four sutures, the margins of the vaginal walls are united by transverse interrupted sutures. Chronic catgut sutures are employed throughout and no effort is made to remove the sutures.

The operation has the following advantages:

1. The diseased, distorted uterus with its increased weight is removed.

2. Prolapse of both rectum and bladder is prevented inasmuch as they are supported on the upper surface of the broad ligaments.

3. The possibility of protrusion of the rectum, carrying with it the posterior vaginal wall, is obviated by the rectovaginal interposition of the levatores ani muscles.

4. The normal length of the vagina is maintained.

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THE ANATOMY AND SURGICAL UTILITY OF SACRO-UTERINE LIGAMENTS

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AND
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The sacro-uterine ligaments, from an operative standpoint, attract very little attention. While they have been the object of occasional study, neither their limitations nor their extensions have been fixed so as to give them a definite place in surgery. The general impression seems to be that they are difficult of access and both structurally and mechanically of doubtful surgical utility.

HISTORY

From 1902 to 1906, Bovée[1] published a series of articles calling attention to the sacro-uterine ligaments. His bibliography shows that as far back as 1850 efforts were made to utilize the ligament in the treatment of retroversion of the uterus. In 1902 he gave an interesting historical account and described the various methods proposed for shortening the ligaments. The technic of these operations, whether the mode of approach was through the vagina or through the abdomen, consisted of folding or doubling the ligaments without actually isolating them. Bovée, however, exposed them by making an anteroposterior incision in the vault of the vagina and dissecting them out. He doubled each on itself and sewed the loop thus formed to the cervix below the normal point of insertion of the ligaments. The incision in the vagina originaly made longitudi-

1. Bovée: Am. Gynec., July, 1902.

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nally was then sewed transversely, which procedure assists in raising the cervix.

In appropriate cases, this is an easy and effective operation. While Bovée's articles attracted considerable attention at the time they were published, the profession has shown no sustained interest in the ligaments as surgical possibilities. The reason is probably because their mechanical importance is not generally understood. Furthermore, none of the operations proposed has appealed to surgeons as clear and mechanically sound methods of utilizing them.

In August, 1911, Jellette[2] of Dublin described a new operation for shortening the sacro-uterine ligaments. This article, to my mind, establishes their surgical value, for it demonstrates an easy and practical method of exposing, isolating and utilizing them as mechanical supports. With this advanced step in perfecting the technic of operating, I believe that shortening them should be accepted as one of the standard methods of treating retroversion and prolapse.

In order to judge whether or not utilization of these ligaments for this purpose is practicable, it is natural to turn to a consideration of their structure, relations and functions.

At my suggestion and for the purposes of this paper, Professor Blaisdell of the Division of Anatomy of Stanford University has made a special study of these structures. Although originally only a brief survey was planned, so many interesting problems were uncovered that his work has grown to monographic proportions and will be published later. The chief practical points of these observations will be given below.

A comparison of authorities leaves one in doubt as to what really constitutes the sacro-uterine ligaments. There are three structures involved—muscle, fibro-elastic tissue and peritoneal folds. So intimately related are they that authorities differ as to which should be in-

2. Jellette: Surg, Gynec. and Obstet., xiii, No. 2.

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cluded and which excluded from the true ligaments. The present study was taken up chiefly to arrive at a clearer understanding of the relations and functions of these tissues.

COMPARATIVE ANATOMY

Considerable light is thrown on the ligaments by observing their analogues and homologues in the lower animals. Here they appear in their simplest forms and one is able to follow the changes from the simple to the more complex. This fact led to the study of a comparative series of animals consisting of guinea-pig, Belgian hare (Fig. 1), cat, dog, and monkey. In this series the parametrial tissue, ligaments and folds were cut in serial sections and subjected to careful histologic analysis.

While each specimen in the series presented interesting differences, the general structure of the tissues under observation was practically the same in all. The condition found in the cat affords a fair example of the series examined.

In animals which habitually assume the horizontal position the uterus is either double or bicornate. It is long and slender and its weight is distributed along an extensive peritoneal attachments, often as far forward as the kidney. This arrangement requires only slight support from the peritoneal folds. There is no need of true or fibrous ligaments. The folds of peritoneum acting as ligaments are very thin and transparent and any fibrous or muscle tissues that may be found in them are only rudimentary structures.

If the bicornate uterus of the cat be pulled ventrad so as to expose the pouch of Douglas, two well-marked folds of peritoneum are seen, in the situation corresponding to the sacro-uterine ligaments. They run on either side of the pouch of Douglas ventrad dorsad, but it will be noticed that the folds are not sacro-uterine, but rectovaginal, inasmuch as they run only from rectum to vagina instead of from sacrum to uterus. In

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none of the lower animals does this ligament show any disposition to connect sacrum and uterus.

MICROSCOPIC STRUCTURE

A transverse section of one of these folds shows under the microscope an interesting condition. In all the animals examined the peritoneum forming the fold was much thicker than the surrounding peritoneum. This hypertrophy was confined chiefly to the fibrous layer or stratum fibrosum. Within this fibrous layer, and therefore distinctly within the peritoneal structure, were found a number of small fasciculi of unstriped muscle fibers. They originate from the uterus, pass first to the fold attached to the vagina and remaining within the fibrous layer of the peritoneum pass backward toward the rectum.

The observation of muscle fibers within the structure of the peritoneum itself is thought by Blaisdell to be new. The muscle fibers found in the ligament are usually described as lying between the layers of the peritoneal fold and are called the recto-uterine muscle, but, as will be shown later, these fibers constitute a separate structure with a well-marked levator function. It is accordingly suggested that they be called the levator uteri muscle to distinguish them from the true recto-uterine muscle.

The muscle fibers situated within the structure of the peritoneum constitute the true recto-uterine muscles. They are found not only in animals but also in the human female. The thickened musculofibrous structure forming the rectovaginal folds in the lower animals are primitive and the sacro-uterine folds in women are the same in histologic structure and function.

In the lower animals, the space between the peritoneal layers of a fold contains principally areolar tissue. The muscle fasciculi and fibro-elastic tissue so abundant in the human female are absent or only rudimentary.

Monkey.—Emphasis is laid on the thin, transparent nature of the peritoneal folds in the lower animals and

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the small amount of weight supported by them. With the assumption of the upright position, the uterus and its appendages sink down into the pelvic cavity and contract into a solid mass. With increased concentrated weight, there is demand for firmer support and we find, coincidently, the development of abundant fibro-elastic and muscle tissue within the folds. In the monkey, for instance, the uterus is undivided and the anatomic conditions are similar to those in women. Here, with the sinking down of the uterus, we find the rectovaginal fold changes to a sacro-uterine and in other respects the structures are human in character, but to a less marked degree.

Woman.—In examining the sacro-uterine ligament in the human female we find that it is much thicker, stronger and more prominent than its homologue in the lower animals. A cross-section shows it to be composed of three main structures: (1) a thickened peritoneum, (2) a fibro-elastic meshwork, and (3) muscle fasciculi. These component parts will be considered separately.

PERITONEAL FOLDS

In the lower animals, the peritoneal structure alone is prominent. The muscle fasciculi and fibro-elastic tissues are only rudimentary. In woman the folds which cover the sacro-uterine ligaments vary considerably in prominence. Sometimes they are only potentially present and appear only when traction forward is made on the uterus. At other times, they may be traced by the eye throughout their course.

Posteriorly, the folds vary in their attachment, sometimes being connected with the rectum and sometimes with the sacrum. Whether the fold becomes recto-uterine or sacro-uterine depends on variation in the position, size and attachment of the rectum. If the rectum is large both folds may be recto-uterine. If the rectum is small, and especially if it has a mesentery, the folds will be sacro-uterine. If the rectum is located to

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one side, the adjacent fold may be recto-uterine and the opposite sacro-uterine.

Another marked feature of the peritoneum is that traction forward on each sacro-uterine fold usually raises the surface into a series of ridges. The meaning of this is that the peritoneum has a direct attachment to the fibers beneath. This attachment was demonstrated by microscopic examination and the fibers of the underlying meshwork traced to the fibrous stratum of the peritoneum. This connection adds considerably to the strength of the true sacro-uterine ligament.

FIBRO-ELASTIC MESHWORK

Beneath the plicae sacro-uterinae, and filling all that space about the uterus called the parametrium, there is found a dense fibro-elastic meshwork. This tissue consists of interlacing fibers ensheathing the vessels and nerves. Careful dissection shows that it is attached to the fascia of the levator ani below, the obturator fascia laterally and the peritoneum above. The general course of these fibers is from the cervix toward the presacral fascia, spreading out to the various points of attachment. It will be remembered that this tissue, while abundant in the human female, is practically absent in the lower animals. Its appearance is coincident with the assumption of the upright position and its function is both to protect and to support. In fact, it may be called the fibro-elastic suspensorium of the uterus.

In a state of rest, the fibro-elastic tissue remains a diffuse network. When traction is made in any direction, condensation occurs along the line of traction and the fibers are thrown into a bundle forming an elastic cord. Remove the traction and by virtue of inherent elasticity or resiliency the tissue resumes its meshwork character. The sacro-uterine ligament is formed from the meshwork by traction in this manner.

MUSCLE FIBERS

The fibro-elastic meshwork about the uterus is interlaced with numerous fasciculi of smooth muscles. These

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are more abundant close to the uterus than in the more distinct parts, inasmuch as they originate from the uterus. They are the cause of the dense or cord-like character of the sacro-uterine ligaments and also of the so-called cardinal ligaments which pass off from the sides of the uterus at the base of the broad ligaments.

These fibers by contraction and by pulling on their attachments to the fibro-elastic meshwork have the power of raising the uterus. They evidently act in response to reflex stimuli. Inasmuch as these muscle fasciculi form a separate structure with a distinct function it is suggested by Blaisdell that it be called the levator uteri muscle.

PLICOVAGINAL LIGAMENT

In studying the course of the fibro-elastic meshwork within the peritoneal folds, it was demonstrated that a distinct mass of fibers ran from the anterior two-thirds of the sacro-uterine fold (plica sacro-uterina) down to the vault of the vagina. The function of these fibers is clearly to sustain the vault-like character of the lateral and posterior fornices.

As they are ligamentary in function and have distinct points of origin and insertion it is suggested that the structure be called the plicovaginal ligament.

SACRO-UTERINE LIGAMENT

The true sacro-uterine ligament is quite distinct from the peritoneal folds and from the muscle fibers found between the folds. It is formed from the diffuse fibro-elastic meshwork. It differs much from our ordinary conception of a ligament inasmuch as it is not a permanent cord, but only potentially so. In function the ligament is inseparably connected with the peritoneal folds and the muscle fasciculi. Acting together the three structures have both a supporting and an elevator function.

The thickened musculo-fibrous character of the peritoneal folds renders them chiefly supporting.

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The fibro-elastic meshwork through its inherent elasticity and resiliency restores the uterus and vaginal vault to their normal position when pushed or pressed down.

The bundles of muscle fibers forming what has been called the levator uteri, by their contractility, raise the uterus in response to reflex stimuli.

It is hardly necessary to compare the supporting value of the sacro-uterine ligaments with that of other uterine ligaments. Their importance is indicated by their structure and conceded by most authorities. Bovée insisted on their value in this direction and Goffe[8] has made the statement that the sacro-uterine ligaments are the most rational structures we can use for restoring the uterus to its normal position. The truth of this remark is readily revealed when we attempt to answer the question, What will support the vaginal vault if the sacro-uterine ligaments fail?

SURGICAL UTILITY

Granting the supporting value of these ligaments, it becomes surgically important to determine whether they may be utilized practically, as, for instance, in restoring the prolapsed uterus and vagina. The surgical utility of these structures depends on (1) their accessibility, (2) on whether their ligamentary character is definite enough to allow of shortening and (3) whether shortening is mechanically effective.

Accessibility.—In relaxed vaginal outlet and in severe cases of prolapse the ligaments are easily reached. If the cervix be drawn down with a volsellum, the cord-like ligaments, may be easily felt with the examining finger. They may be outlined and their size relations and point of insertion into the cervix determined. The simplest method of exposing them after they have been located is to make a circular incision about the cervix as proposed by Jellette and dissect back the cuff of mucosa until the insertions may be plainly seen. They

8. Goffe: THE JOURNAL A. M. A., July 5, 1902, p. 16.

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may then be isolated by blunt dissection, and even cut away from the uterus if deemed necessary. In cases of prolapse, I have been in the habit of exposing them by removing a small triangular flap posterior to the cervix. This procedure not only gives access to the ligaments but at the same time allows for transposition of the cervix to a higher position.

Ligamentary Character.—After exposure they may be isolated by pushing a clamp beneath them. By further dissection they may be completely separated from the uterus. They appear to the eye like loose bundles of muscle fibers forming a cord of considerable size and length, which may be manipuated as a ligament.

MECHANICAL UTILITY

After exposing the ligaments a few tests will show that they may be doubled on themselves as proposed by Bovée; sewed to each other as proposed by Byford or separated from their attachments and sewed to a new position as proposed by Jellette. Shortening is attained by any of these methods and the practical result of lifting the cervix follows as a matter of course.

The strength of the ligament is sufficiently attested by its size and resistance to tension. When it is remembered that the fibro-elastic meshwork from which the ligament is derived has a very broad attachment to surrounding fascia, and especially an insertion into the musculofibrous layer of the peritoneal fold, its ability to hold up the cervix becomes self-evident.

CONCLUSION

In conclusion, the object of the above study has been to arrive at a clearer understanding of the anatomy and surgical value of the sacro-uterine ligaments. I have had the opportunity of operating on these ligaments ten or twelve times, and as a result of both study and experience feel (1) that they are worthy of more general attention; (2) that the operation of shortening

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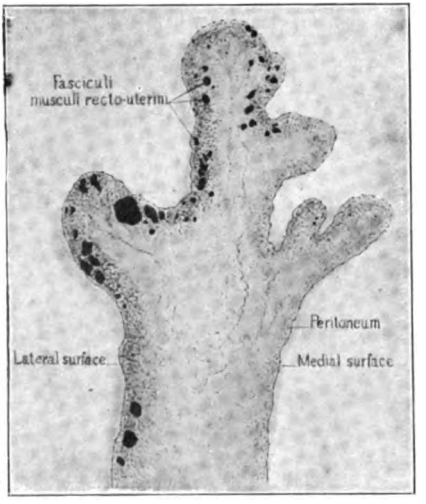

Fig. 1.—Transverse section of rectovaginal fold of Belgian hare.

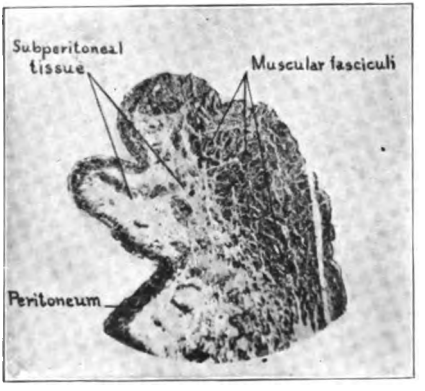

Fig. 2.—Transverse section through right recto-uterine fold in anterior part of middle third of child of 10 years.

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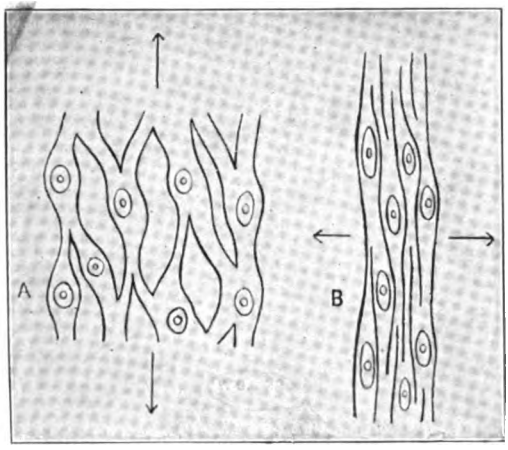

Fig. 3.—Fibro-elastic meshwork which forms (a) potential, (b) temporary sacro-uterine ligament.

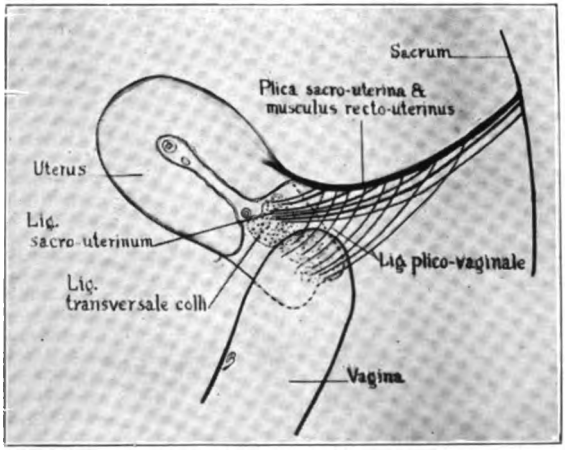

Fig. 4.—Diagram showing origin and attachments of sacro-uterine ligament.

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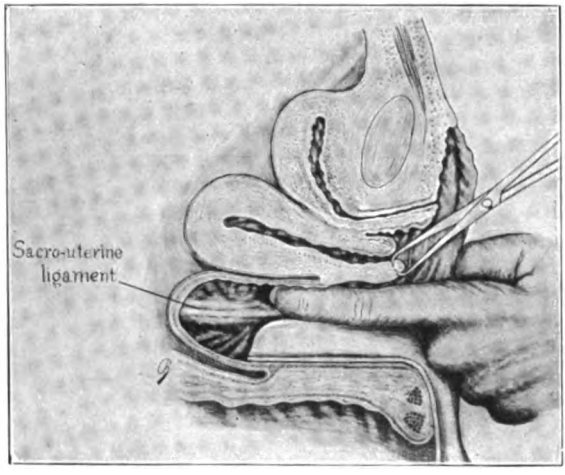

Fig. 5.—Palpation of ligament.

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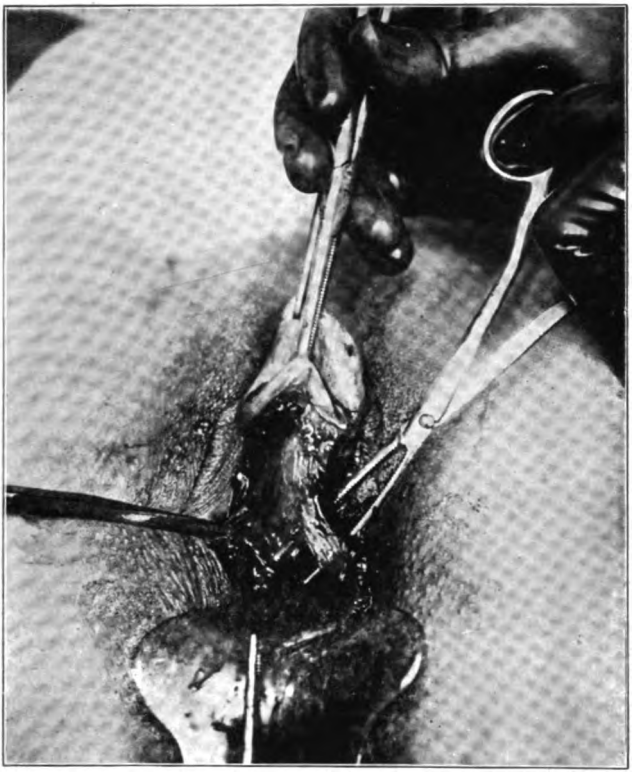

Fig. 6.—Sacro-uterine ligament exposed and isolated.

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them is both practicable and successful, and (3) that it is particularly indicated when retroversion or prolapse is accompanied by relaxed vaginal vault.

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ABSTRACT OF DISCUSSION

ON PAPERS OF DRS. MARTIN, MONTGOMERY AND SOMERS

DR. A. E. BENJAMIN, Minneapolis: This subject is a very important one. Operators have different points of view. One man has corrected this prolapse by the vaginal route, another by the abdominal. It is for the purpose of crystallizing our ideas and coming to some definite understanding regarding the proper position of the uterus and the underlying factors that we discuss the matter fully. I think most of us should study anatomy more thoroughly and especially the anatomy of the female pelvis, if we are to understand why we have prolapse and do this work properly. What is the mechanism and what are the factors necessary for the proper position of the uterus, and why do we have prolapse or misplacement of this organ? When we arrive at a thorough understanding of this subject our opinions will differ but little. I agree with what Dr. Martin has said in regard to prolapse in women past the menopause. The Watkins-Wertheim operation is satisfactory and I have had more women return to me expressing their gratitude for the results of this operation than for those of any other perhaps. It seems to be founded on the right principle, taking into consideration the anatomic structures and elevating the rectum which is prolapsed and in which we have a rectocele. It elevates the prolapsed bladder and does not interfere with its function. There is not the pain and discomfort so often encountered if the bladder is not properly replaced. Dr. Martin's idea of fastening the fundus a little higher up on the bladder and the use of the utero-vesical ligaments is one we should all recognize, so that our patients who have not passed the menopause may have the benefit of this method. It has been most difficult to get a uterus to stay in place after prolapse in women past the menopause and especially when the tissues have atrophied. One feature which we must consider is the intra-abdominal pressure. Very few of these uteri will prolapse if there is not a force above pushing them down.

DR. WILLIAM M. POLK, New York: The difficulty in dealing with the questions that have been presented grows out of the fact that we have so many admirable operations devised for this troublesome condition. Is this a hernia? If so, how does it compare with other hernias, and which is the best way of meeting the difficulty? There are certain general principles that we all recognize as accepted in all cases of hernia. First among these is the principle that the peritoneal

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support shall be of the first order. Unless we take care of the sac, no matter how skilfully the operation is performed, it is worthless. The weak point in the pelvis is the region of the bladder; the strong part, the region of the sacrum. If we can overcome the tendency to weakness in the bladder region, we can solve the question of prolapse. In spite of the variety of methods, however, there is ample room for all, because the varieties of procidence are almost infinite. Not only are each and all subject to different methods of procedure, but the condition of the patient also must always exercise a potent influence on the measure it is proposed to adopt. A woman of 60 whose tissues have undergone fatty degeneration is not in condition to make good an operation applicable to a woman of 30. There are conditions of congenital defects in these muscles which make certain procedures difficult in certain women. In certain women no changes have taken place in the levator ani muscles that make it a difficult matter to build the support from below. In others, especially the obese, the structures to which surgical skill is applicable are from the outset defective. There is no doubt, therefore, that in these various conditions presented to us we shall find the appropriate operation among those suggested. The beginnings of prolapse are always easy to correct. Operators should bear in mind that not only is it essential to have support from below, but that it is also of the highest importance that there is resistance from above. It must be understood also that the region of defect is to the front of the uterus rather than behind it. While every effort should be made to strengthen the support of the uterus, notably the use of the sacro-uterine ligaments, without adequate attention to the anterior supports of the uterus all measures will be in vain. Therefore, the anatomic and pathologic problem to be faced is this, that when prolapse begins, it begins from below posteriorly by lessening of the support there, but that in a short time the prolapse is increased by the insufficiency of the support above. Every measure should be resorted to that will shorten and make shallow the peritoneal surface that lies between the uterus on the one hand and the symphysis pubis on the other. There are a number of these procedures.

Dr. Walter B. Dorsett, St. Louis: We must consider the subject from the point of view of physiology as well as from that of pathology. We have to judge as to what constitute the natural and normal supports of the uterus. In my opinion each has its special function to perform. Aside from the different ligaments that support the uterus, we must not lose sight of one of the most important factors in the natural position of the uterus, and that is the intra-abdominal pressure. The intra-abdominal pressure on the uterus is on the posterior wall when it is in its normal position and on its anterior wall when it is retroverted. The deviation from the

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normal allows the uterus to sag down and feed itself, as it were, into the vagina. The uterine sacral ligaments are, so far as I have been able to observe by section and by digital examination, unimportant factors in the support of the uterus, and we must study them from a physiologic and from a pathologic standpoint. Dr. James N. West discussed this question in 1904. He proved experimentally that the uterosacral ligament does not enter forcibly into the consideration of the support of the uterus.

I wish to call attention to the different actions of tissues composing ligaments and those composed chiefly of muscle in the cadaver when subjected to strain. In cases of retroflexion with congestion of the body of the uterus, the uterosacral ligaments hold the uterus in a retroflexed condition, and I dare say that all of us, in examining these cases, when we have passed the two fingers into the posterior vaginal fornix and made pressure, have felt it slide up beyond these ligaments and out of our reach. I believe that in these cases of retroflexion, the uterosacral ligament holds the uterus in a retroflexed position, but I do not believe that it has an important rôle to play in holding it in position, because of the fact that peritoneal tissue and very little muscle tissue hold it in place. I have never done the operation. I do not believe that it is a good operation, however, for the reason that it is done through the vagina. If such a condition could be brought about through the abdominal wall by making a folding of the round ligament on itself, if it had sufficient muscle tissue to hold it there, I believe that the operation would be a good one.

Dr. J. Riddle Goffe, New York: I have utilized the uterosacral ligaments for many years and I am a firm believer in their utility. Dr. West, in describing his experiment by which the uterine ligaments were put on the stretch, said that the uterosacrals were the first to show tension. That is evidence of their relative importance in maintaining uterine equilibrium and of the very slight support needed by the uterus when in the normal position. Only when retroverted can we need the firmer and stronger ligaments. The uterosacral ligaments are all-sufficient when the uterus is in normal position.

In the operations described this morning the entire stress was laid on the anatomy and the pathology discovered. The physiologic functions were entirely ignored. The doctors speak of putting a plug in the hernial hole, of building up a bottom to prevent things from coming out, and Dr. Montgomery even speaks of the interposition of muscles. I should not consider the interposition of muscles for closing this space. I should restore those muscles to their normal position so that they can perform their normal function, which is to lift the anus in defecation and deflect intra-abdominal or

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pelvic pressure. They are not plugs or dead tissues; they are vital energizing tissues and we should look to their function and then restore it, and not the anatomy only.

I must disagree with Dr. Polk in his assertion that the weak spot is in front. In the great majority of these cases the uterus comes down first, then the rectum and finally the bladder. The support in front is, as a rule, the last to yield. Therefore, in all these operations, if the woman is in the child-bearing period, we must first restore the uterus to its normal position, then look after the bladder and lastly the rectum.

There has been no reliable principle up to a very recent date on which these operations can be based. Drs. Benjamin and Dorsett have struck the keynote in referring to the intra-abdominal pressure. It is the direction and control of the intra-abdominal pressure that determines whether or not the uterus will stay in place. The intra-abdominal pressure when it impinges on the uterus forces it down until the ligaments are taut. The cervix gives way and allows the uterus to tilt up sufficiently to deflect the pressure into the pelvic outlet.

The thing we want to look to is the proper restoration of the uterus to the normal position in child-bearing women by restoring its ligaments so that it can meet and control intra-abdominal pressure when it comes down in the pelvis. I have an operation that is applicable to child-bearing women, and that is modified to meet conditions that come later in life. In child-bearing women I restore the uterus to the normal position, shorten the ligaments to permit it to meet the abdominal pressure efficiently, and then stitch up the bladder so that it will be suspended from above.

In elderly women, at the menopause or later, I remove the uterus, but restore a deflecting plane made up of the broad ligaments to control and direct the intra-abdominal pressure. That is the entire principle and explains why it is that the uterus is retained in place so easily when in its normal position and why, when it is not, we have these disastrous consequences.

Dr. Robert Earl, St. Paul: The crucial point in the consideration of the various operations for prolapse of the uterus is whether or not the uterus is suspended or supported. What maintains the uterus in position? The peritoneum, blood-vessels, ligaments, pelvic-floor muscles, pelvic fascia, fat and skin must be considered. That the peritoneum cannot hold the uterus in position is evidenced by the fact that hernia occurs if there is a constant fight between intra-abdominal pressure and the peritoneum. That the blood-vessels and nerves cannot hold the uterus in position is evidenced by the fact that there is a marked elongation of the blood-vessels and nerves in cases of floating kidney or other loose abdominal organs. The round ligaments never hold the uterus in position

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because they are curved. You can place a forceps on the cervix and pull the uterus down and out and the round ligaments will not become tense or straight. The uterosacral ligaments do, in a considerable measure, help to maintain the uterus in position by suspension; but, the uterosacral, like the round ligaments, are made up of muscle tissue of the uterine type and one of their functions is to hold the uterus down, aided by abdominal pressure, during the pains of labor. One of the functions of the round ligaments is to hold the body of the uterus forward, and the function of the uterosacral is to hold the cervix back, thereby maintaining the uterus on a horizontal plane in order that the abdominal pressure shall strike the uterus on its broad, flat surface, forcing it against the vaginal walls and forcing all against the most resistent part of the perineum. The broad ligaments being composed of peritoneum, connective tissue and blood-vessels all stretch. The levator ani muscle is practically an abdominal-wall muscle. It contracts synchronously with the other abdominal-wall muscles. Were it no so, we should have bulging of the perineum during inspiration. In spina bifida and injury of the fourth sacral nerve, prolapse of the pelvic organs occurs in the female and a bulging of the perineum in the male. This I believe is conclusive proof that the pelvic organs are supported by the muscular perineum and are not suspended by the ligaments.

There are many operations recommended, but each operator concludes by saying that the operation must be completed by building up the perineum. I believe that that is the secret of success in all of these operations—the building up of a good muscular perineum. When the perineum is relaxed it is because of laceration, atrophy, dilatation or weakness of the muscular tissue. Then the intra-abdominal pressure forces the pelvic organs gradually out; therefore the weakened pelvic floor is the main cause of prolapse. In those cases in which it is not possible to build up a good muscular perineum, either the uterus or stump of the cervix must be anchored securely to the anterior wall of the abdomen or there will be a considerable percentage of failures.

Dr. A. Goldspohn, Chicago: In the Wertheim-Schauta-Watkins operation the uterine cavity becomes wholly inaccessible. This is serious. We know that senile endometritis is frequent enough in women who have not a sufficiently distorted position of the uterus to invite it. I should abhor creating that condition in the pelvis of a woman even if she could not conceive. I think that it would be better to remove the uterus, although that is not the best way of curing the prolapse. We can utilize that old uterus in curing the prolapse and simplify the operation in these decrepit women by not removing it. I am glad to hear emphasis laid on the proper reconstruction of a foundation from below by getting together

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the lateral halves of the levator ani muscle and the deep pelvic fascia in a firm union in the median line by transversely placed sutures, not one inch from the vulva as Dr. Martin suggests, but two inches. It cannot be done with less than that. It was my privilege fourteen years ago, to introduce the procedure known as "intrapelvic, intravaginal perineorrhaphy without loss of tissue." I am sorry that I have neglected to say much about it since that time.

If you will make an actual restoration of the pelvic floor, the morbid conversion of things that Wertheim proposed is not necessary. It will be sufficient simply to detach the bladder from the front of the uterus and hang the uterus in a perpendicular position, not horizontally, simply turn it forward half as far, a quarter instead of a half of the circle. Then place the bladder, the mischief-maker, where it cannot do harm, that is, on top of the fundus of the uterus, and anchor the uterus firmly to the anterior vaginal wall. Then build up the right kind of foundation from beneath. In some extreme cases of old women, in whom the parts have become extremely relaxed, atrophy is an important factor. It is better in these cases to make a ventral incision and anchor the fundus of the uterus to the abdominal wall by a Gilliam operation well drawn up, plus ventrofixation by a fibrofibrous union. This gives a union that will never let go. Then you must do a real restoration of the pelvic floor.

The operation to be discussed is not prolapse of the uterus in women who are no longer to bear children, that I regard as practically accomplished. The question before the profession is to find an operation that will be curative in young women who are yet to bear children; that class of women we have few of in this country, but many abroad. The efforts of Dr. Martin in that direction are commendable; but I would call attention to the fact that his suggestion of drawing the sacro-uterine ligaments from behind and uniting them in front of the cervix is an operation of a man in Dublin, published about two years ago. The anatomic study of Dr. Somers calling our attention to the importance and great utility of the uterosacral ligaments is exceedingly commendable.

Dr. George Gellhorn, St. Louis: The multiplicity of conditions encountered makes it imperative that we familiarize ourselves with a number of operative procedures. It is obvious that an operation which is indicated in a woman at or near the menopause cannot be applicable during the child-bearing period; nor can a method by which a uterus may be saved be equally suited to cases in which the uterus must be removed, for instance, in fibroids. What becomes of our boastful principle of individualization in medicine if we operate on every patient by the one method that we happen to know best, or by chance have originated ourselves? The Wertheim-Schauta-Watkins operation is excellent in certain well-defined cases,

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but totally unsuited for women in the child-bearing age. For these the Vineberg method will be found to have many attractive features. The Goffe and Polk methods and a dozen others are available and advisable in certain cases, but none of them is complete without a solid perineorrhaphy.

DR. G. BETTON MASSEY, Philadelphia: I believe that if surgeons will refer their patients after operation, and possibly some of the younger women before operation, to adequate treatment of muscle-exercising character, they will get far better results. They are not dealing with a fibrous skeleton alone, but with muscular tissue. We have come back to the belief in the importance of support from below. Muscular tissue is above, in the abdominal wall, as well as below. We should restore the abdominal tone, and that can be done effectively by powerful galvanic currents turned on and off rhythmically. A more recent current for that purpose is known as the sinusoidal current, having to a great extent the characteristics of the old galvanic current and of the faradic current. Either of these currents is particularly applicable to younger women. I think all will usually fail in older women. I urge it after operation and before operation. It should be done, however, by a man who understands its application, and it should be continued for an adequate length of time, which is not less than three months.

DR. E. E. MONTGOMERY, Philadelphia: I endeavored to leave the impression that the operation which I suggested was limited in its application to a certain class of cases. I do not wish to be understood as advocating the removal of the uterus in every case of prolapse. That has been mentioned by the men who have discussed this subject. It is important that we consider the various conditions which maintain the uterus in its proper position. This is not the peritoneum alone, nor the muscular structure. It is a combination of all the structures working together that serves to keep the organ in its proper position. It is impossible after an extensive prolapsus to restore these structures to their normal relation. We are obliged to bring them together and place them out of the ordinary relation and situation in order to accomplish restoration and prevent hernia. In this displacement there is, as mentioned by Dr. Polk, a weakened position, generally in front, which permits sliding down of the bladder; the uterus may push down in the center. There is also a weak point between the levator ani muscles and the rectum. We see through this prolapse of the rectum in women who have not given birth to children. It is simply a diastasis of the levator ani muscles which permits the rectum to come down between them. If this has continued for a length of time the rectum becomes adherent to edges of the muscles. The levator ani muscles can be brought together in front to form a wall to prevent protrusion of the rectum. It is important,

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as mentioned by Dr. Earl and Dr. Goldspohn, that this operation should be carried high on this muscle so that the muscle wall shall be brought together in front of the rectum for some distance. I have seen cases in which after operation hernia recurred; the intestine and peritoneum pushing down caused stretching and atrophy of the structures below, requiring subsequent operation. The uterus can be retained in position by folding together the structures. Dr. Polk was modest in not having mentioned an operation of his own device, that of dissecting down between the bladder and uterus in front, folding together the structures so as to hold up the uterus, then shortening the broad ligaments posteriorly, bringing the uterosacral ligaments over them in such a way as to maintain the uterus at a higher level. I wish also to commend the operation described by Dr. Somers as being an exceedingly valuable addition to the subject of displacements of the uterus.

Dr. George B. Somers, Omaha: My interest in the sacrouterine ligaments is directly connected with my interest in the problem of curing prolapse. It is quite apparent from the papers and discussions presented to-day that men who have attempted to devise operations solving the problems of prolapse have divided themselves into two camps, and in their operation of choice one camp advocates the removal of the uterus, the other its preservation. The two principal papers to-day illustrated this. One author advocates the Wertheim–Schauta–Watkins operation; the other, an operation that I think we may safely attribute to Dr. Goffe, namely the removal of the uterus and the uniting of the round and the broad ligaments together as a support below. There would be no quarrel at all on this subject if it were not for the operation of choice. If anybody says that the removal of the uterus is the operation of choice, then at once the conservative camp rises in arms. On the other hand, those who advocate removal will say that the preservation of the uterus is not a surgically attractive procedure. When we can agree that one operation is good in one case, and that the other operation is good in another, then the problem is settled. I think that Dr. Montgomery in prefering hysterectomy saved himself from completely going over to the enemy by saying that he did not advocate removal in all cases. When it is necessary to remove the uterus, then the operation described by Dr. Montgomery is the best operation that can be performed. When a cystocele complicates prolapse, the anterior vaginal wall must be supported. There are two ways of doing this: (1) by placing the uterus beneath the bladder or (2) by removing the uterus and bringing the round ligaments underneath. My preference is for the former for conservative reasons.

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Returning to the sacro-uterine ligaments, my attention was directed to them by the fact that in the operation of vagino-fixation we frequently find that the uterus will assume a flexed position after the operation is completed, because the cervix is left without support. The only remedy for this that I can see is the use of the sacro-uterine ligaments, shortening them so as to lift up the vaginal vault.

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A STUDY OF THE END-RESULTS OF THE BALDY-WEBSTER OPERATION

JOHN OSBORN POLAK, M.D., M.Sc.
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In this brief paper, which is based on a personal experience of over 400 cases, I shall attempt to draw conclusions from the end-results of the Baldy-Webster operation.

THE PRINCIPLES OF UTERINE SUPPORT

The uterus is a freely movable organ and is suspended in the pelvis between the abdominal cavity and the pelvic floor by the harmonious action of all of its supports; that is:

The pelvic floor.
The adjacent pelvic organs.
The retentive power of the abdominal cavity (intra-abdominal pressure).
The several ligaments.
Finally, by the normal relation which the uterine axis bears to the axis of the vagina.

The axis of the uterus with the bladder and rectum moderately full conforms with the axis of the pelvis, and is nearly at a right angle with that of the vagina. With the bladder empty, the axis of the vagina is almost horizontal and runs almost directly backward, while the uterus is directed forward at an acute angle.

Normally, the fundus of the uterus is at or a little above the level of the pelvic brim, while the inferior extremity of the uterus, the cervix, projects into the vagina and is directed toward the last sacral vertebra. With all the adjacent pelvic structures in their normal

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state, the cervix is more or less a fixed point, lying in the plane of the ischial spines, a little posterior to the center of the pelvis. The cervix is held in this position by the uteropelvic ligaments and the uterosacral ligaments and the vesicovaginal fascial plate; the body rests on the pubic shelf.

The normal axis of the uterus has a wide range of inclination, depending on the degree of fulness of the bladder and rectum; the uterus moves upward and downward with each respiratory excursion and changes its position with that of the body.

THE ACTION OF ITS SUPPORTING LIGAMENTS

The uteropelvic ligaments consist of bands of muscle fibers running outward from the supravaginal portion of the cervix to the pelvic fascia, within the base of each broad ligament; they prevent the uterus from undergoing lateral changes in position and help materially in preventing uterine prolapse. The broad ligaments act in some measure to steady the uterus in or near the median section of the pelvis. The uterosacral ligaments pull the cervix backward and upward, thus tending to antevert the body, while the round ligaments act as stays or "guy-ropes" to draw the uterus forward and prevent it from falling backward. The round ligaments are muscular bands covered with peritoneum.

WHAT THE BALDY-WEBSTER OPERATION DOES

The Baldy-Webster operation elevates the uterus and its adnexa and holds the fundus forward. This is accomplished, according to Baldy, by three forces:

1. The intra-abdominal pressure on the posterior fundal wall.
2. The encircling band formed by the round ligaments.
3. The downward pull of the round ligaments on the uterine cornua.

In this operation the uterus is upehld by the encircling loop of the round ligament which is sutured to the posterior surface of the body, in a line just below the level of

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insertion of the utero-ovarian ligament. The ovaries and fallopian tubes rest free of broad ligament attachment on the round ligaments, as they pass through the broad and under the utero-ovarian ligaments.

The perfect correction of a retrodeviation of the uterus by this operation must therefore depend on the following conditions:

1. A cervix held backward and upward by well-developed uterosacrals.

2. A good pelvic floor to preserve the position and integrity of all of the pelvic organs.

3. A uterus of moderate size and weight, and round ligaments of equal length and thickness which can be made to encircle the uterus.

The technical difficulties of the operation are for the most part insignificant, yet they are present.

POSSIBLE COMPLICATING DIFFICULTIES IN THE TECHNIC

Clinically, we find that the round ligaments are frequently unequally developed in length, thickness, and in muscular tone; this is commonly so post partum, when the retroversion or flexion is associated with subinvolution, descensus and pelvic injury. The use of such ligaments for the Baldy-Webster operation must necessarily produce a lateral version of the uterus, and this has been an end-result too often noted (Fig. 1).

Varicosities of the veins of the pampiniform plexus are common to all retrodisplacements with descensus. The passage of the round ligament through the opening made for it by blunt dissection in the broad ligament may injure these veins of the utero-ovarian anastomosis and give rise to troublesome bleeding, the control of which by ligature may further interfere with the venous circulation, or even produce a thrombophlebitis which may extend from the pelvis to the femoral or the saphenous vein. Thrombosis has been relatively more frequent following this operation than after other procedures on the round ligaments.

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Strangulation of a portion of the ligament which has been drawn behind the uterus is not uncommon, and has occasioned in several instances a local peritonitis. Congenital or acquired adhesion of the sigmoid to the posterior surface of the broad ligament may complicate the technic by relatively shortening the ligament on that side.

Unless the ligaments are fastened low enough on the posterior uterine wall, i.e., just below the level of the utero-ovarian insertion, there is a tendency for the ovaries to be carried upward and to be thrown over forward with the rolling forward of the broad ligaments; they may even be rolled into the anterior peritoneal pouch, while if the attachment is too low, the ligaments serve as a loop over which the body may bend, making a retroflexion out of a retroversion.

Torsion of the ligaments is a common error in technic, the importance of which is apparently not appreciated by many operators; this always gives rise to swelling from obstruction to the circulation of the ligament, and local peritonitis with more or less extensive local adhesions. I believe that the severe inguinal pain noted following some of these operations may be attributed to this cause.

To the critics who state that the Baldy-Webster operation puts a strain on the weakest part of the ligament, i.e., the portion nearest the inguinal canal, I would state that this operation does not claim to suspend the uterus by supporting or hanging it by the round ligaments, as does the Gilliam, but simply draws the fundus forward, and if the cervix is well back and firmly held there by the uterosacrals, intra-abdominal pressure will retain the organ in anteversion.

ITS EFFECT ON THE POSITION OF THE OVARIES

The ovaries are elevated by this operation. This is accomplished in the following manner:

1. By the general elevation and anteversion of the uterus.

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2. By the rolling forward of the top of the broad ligament, owing to the pull backward of the round ligament as it passes through the hole in the broad ligament. The patency of the tubes, if free from adhesions, is not interfered with by this disposition of the round ligament.

In almost all cases of retroversion of long standing there are varicosities of the broad ligaments, and changes in the size, position and histology of the ovaries, which result in prolapse, thickened stroma and cystic degeneration, making it imperative, in order to secure a symptomatic cure, that the basic causes as well as the position be corrected, i.e., that the pelvic circulation be equalized, not obstructed. In the ideal case in which the uterus is not too heavy, the ovaries and tubes are normal and the cervix is held well back toward the sacrum by its supports; i.e., the uterosacral and the uteropelvic ligaments. Shortening the round ligaments by encircling the uterus with the loop of the round ligament meets all of the claims of its originators; but when the uterus is heavy, the round ligaments attenuated or unequally developed, and the cervix points forward, either because of congenital malformation, or as a result of the stretching of the uterosacral ligaments, the uterus will fall into lateral version or sag in the pelvis. What really takes place when the uterus sags may be illustrated by attempting to lift a small boy by placing your arms under his axillae and embracing him with your forearms. He can't get away except by sliding from your embrace by raising his arms. So the uterus slides out of the encircling band down into the pelvis, raising the ovaries and throwing them inward toward the median line, where they may become adherent to one another, behind and above the ligamentous sling (Fig. 2).

Yet no operation for retroversion of the uterus seems to meet the indications so perfectly as does this one of Baldy's, when all conditions are favorable.

The technic in my clinic has been slightly varied from that described by Baldy in 1910. I have felt that grasp-

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ing the ligaments with "guy-ropes" causes less trauma than catching them with clamps. Again, I have substituted a Cleveland ligature carrier for the clamp to pass through the free space below the ovarian ligament, as being less likely to injure the blood-vessels than the Kocher forceps. I have generally spread out the loop of each round ligament on the posterior surface of the uterus, fixing it at three points; i.e., in the median line to its fellow from the opposite side; to the utero-ovarian ligament at the point at which the folded ligament passes through the broad ligament, and to the uterine wall midway between these two points (Figs. 3, 4 and 5).

From a study of the records of the 400 operations in my clinic from Jan. 1, 1908, to Jan. 1, 1913, I make the following summary:

SUMMARY

Twenty-four patients have been lost track of and have not been seen by either my assistants or myself since their operation, thus leaving 376 for analysis. These women have been watched for periods varying from five months to five years and many of them have been examined repeatedly. Two hundred and two, or more than 50 per cent., have perfect pelves; the uterus is in its anatomic position in the pelvis and free from adnexal or parametrial inflammation. Of this number, 160 have had complete relief of all pelvic symptoms.

Thirty-nine having an anatomically perfect pelvis, still complain of pelvic pain, with burning sensations over the lower abdomen, and suffer from menstrual pain in the back and side.

Three have died from causes independent of the operation before or soon after leaving the hospital. It is among the remaining 174 that we find our complications and disappointments.

Fourteen have had secondary operations for pelvic or abdominal conditions, and the intra-abdominal pathologic conditions in each have been carefully studied and the findings recorded. These have shown that:

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1. Unequal development of the ligaments does occur and lateral version of the uterus follows; this I believe to be due either to torsion of the ligament from defective technic, or to unequal primary development, present but unnoticed at the time of the operation.

2. Enlarged ovaries slung over the encircling band formed by the round ligaments fall lower in the pelvis by elongation of the utero-ovarian ligament and become adherent. These ovaries (Fig. 6) have been cystic (mycrocystic).

3. The sigmoid is apt to become adherent to the ligamentous loops.

4. The ligaments passed behind the uterus may become edematous from constriction and offer an inflammatory surface for intestinal adhesion.

5. When the uterus is large and sinks in the encircling loop, the ovaries are thrown upward and inward and become adherent to one another behind the uterus, forming a sensitive mass; these findings have been constant in the cases reopened; hence we would judge that some of this pathology is a cause in many unrelieved patients.

In thirty-two patients the uterus has relapsed and was found retroverted and prolapsed, carrying the ovaries with it.

Thirty are wearing pessaries.

Eighteen have not been benefited in any way.

Ten have lateral versions of the uterus and complain of pain in the side toward which the fundus is drawn.

Sixteen have prolapsed and cystic ovaries.

Two women have ovaries lying anterior to the broad ligament.

Twenty-six have had thrombosis of the pelvic veins, which has extended to the femoral and saphenous, which gives a morbidity larger than we have had from any other intra-abdominal operation.

Twenty women have had children subsequent to the operation.

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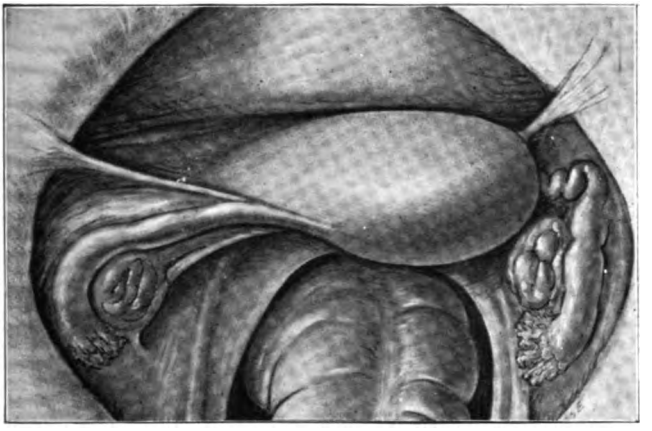

Fig. 1.—Lateral version of the uterus.

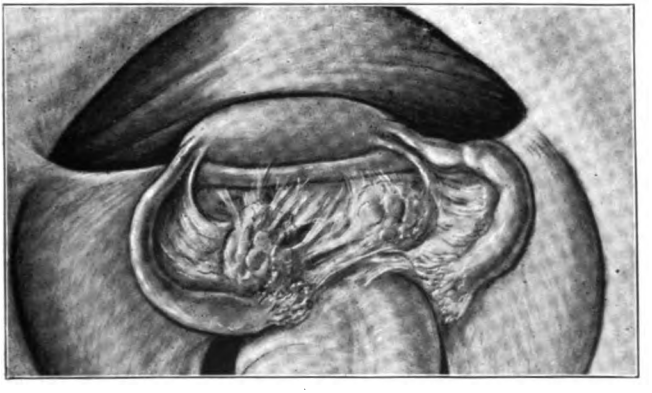

Fig. 2.—Ovaries adherent to one another and thrown upward and inward by heavy uterus slipping out of sling.

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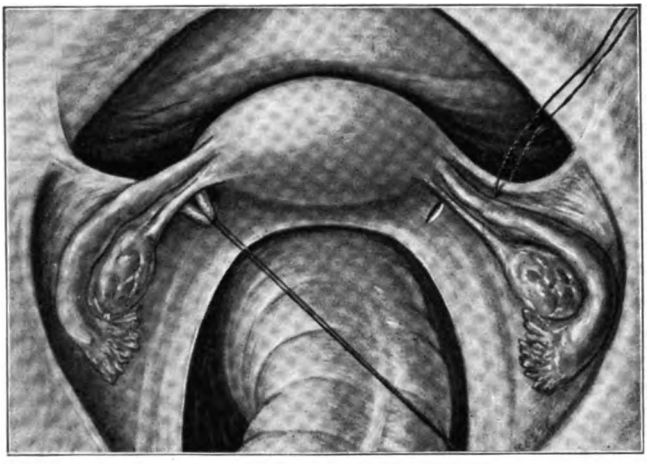

Fig. 3.—Author's technic.

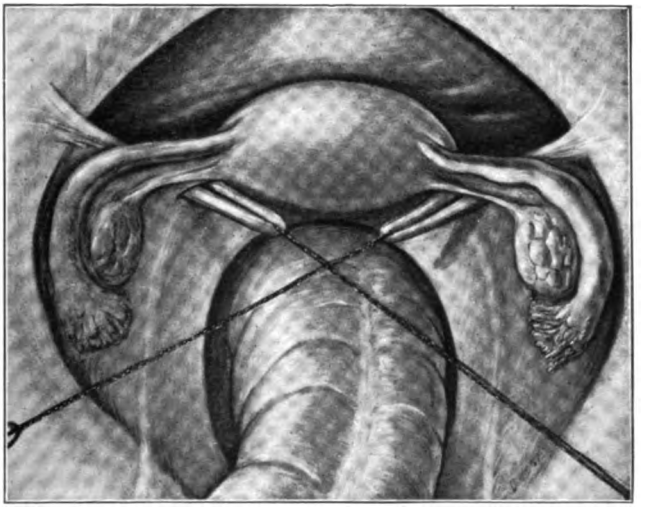

Fig. 4.—Author's technic.

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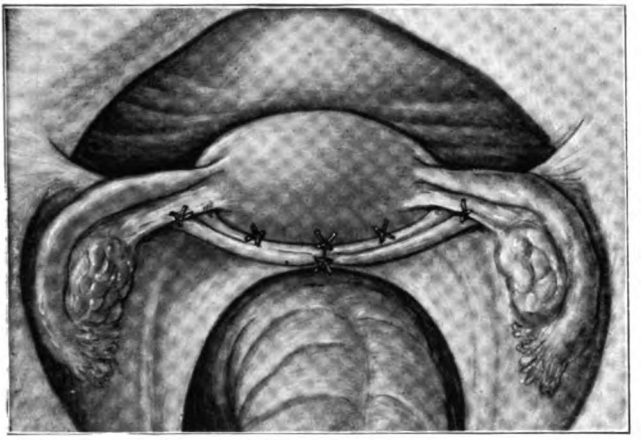

Fig. 5.—Author's technic. Sutures in place.

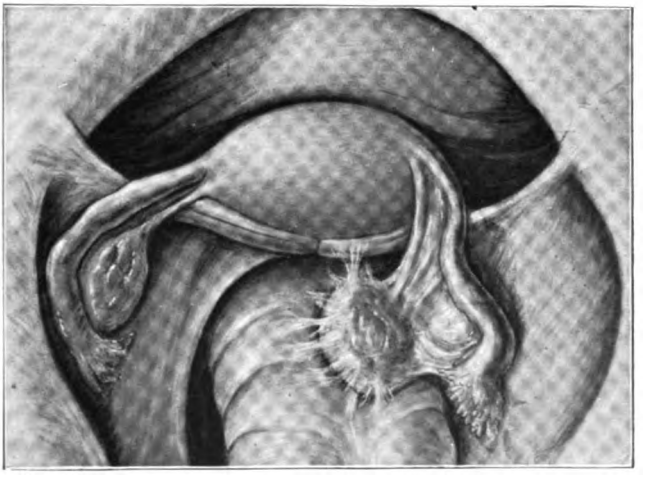

Fig. 6.—Further elongation of the utero-ovarian ligament due to enlarged ovary.

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Twenty-two have aborted, making in all forty-two pregnancies from which to make observations. No complication of labor has been recorded; only one delivery has required forceps.

Fourteen of the women becoming pregnant have had great pain and discomfort during the first trimester; only four of our relapses have followed labor.

CONCLUSION

From these observations it would seem that the Baldy-Webster operation has a definite field of usefulness in properly selected cases of retrodeviation of the uterus when intra-abdominal shortening of the round ligaments is employed. It should not be selected for heavy uteri with the cervix in the axis of the vagina. Its success depends on a small uterus, a cervix pointing backward, equally developed ligaments and a careful technic.

287 Clinton Avenue.

ABSTRACT OF DISCUSSION

DR. EDWARD REYNOLDS, Boston: The Webster-Baldy operation is, I think, the best of the round-ligament operations, but I think that there is a word more to be said. Dr. Polak has told us that the normal position of the uterus is maintained by the harmonious action of all its supports. A very important corollary is that, in the majority of cases of retroversion, the condition is due primarily to the existence of a tendency toward retroversion due to the inharmonious action caused by an unequal development of those ligaments. The uterus is an organ which is suspended, and when it retroverts it revolves about a point which is approximately the attachment of the bases of the broad ligaments where the uterine arches approach the cervix. A band formed by the anterior attachments draws the cervix forward and down, while the uterosacral muscular structures lift the cervix upward and backward. If the Webster-Baldy or any other round ligament operation is applied to a case of this kind an anteflexion of the fundus is created in addition to the anteflexion of the cervix. Dr. Somers has told us that the only expedient he can see is to shorten the uterosacral ligaments and pull the cervix upward and backward. That operation has been before the profession for many years and has not met with much favor because it is an incorrect procedure. For six years or more I have been doing an operation which I believe is a much better procedure. I make a transverse

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incision through the uterovaginal plate, extending through the whole thickness of the anterior vaginal wall in front of the cervix and large enough to admit a finger. I pass the finger in and separate the bladder from the anterior surface of the cervix and then break up the connective tissue and muscular tissue which we call the vesico-uterine ligaments, leaving the cervix free from all the attachments which drag it forward and downward. I then bring the incision together with transverse sutures. With the Webster-Baldy operation I bring the fundus forward, and the uterosacral ligaments lift the cervix backward.

DR. R. S. YARROS, Chicago: I have watched the Webster-Baldy operation as done by one of its originators for several years, and I have seen more bad results from this one operation than from almost any other. In several cases I saw all the complications that Dr. Polak mentions. One of the cases, if I remember correctly, had three of the complications. It was a simple case of retroversion, with a slightly enlarged uterus and an enlarged ovary. The operation was done and part of the ovary removed. Two years afterward the woman was operated on and it was most difficult to separate the uterus from the bladder. The result was a hysterectomy. Two other patients had to be operated on within two years, not only for discomfort, but for severe pains.

I have come to the conclusion that it is a mistake to displace the anatomic relations. The Webster-Baldy operation seems to me a fundamental mistake, unless it is done as guardedly as Dr. Polak suggests. First, however, how is it possible to measure the ligaments and say that they are equal? If one is clever enough to forestall all these points no doubt the operation has a place. I am sorry that Dr. Webster is not here himself to say all the good things in favor of the method, for Dr. Polak certainly did not say many things in its favor.

DR. C. W. BARRETT, Chicago: We are indebted to Dr. Polak for so honestly reporting such unfavorable results. His results have shown the evils of the operations which were pointed out theoretically a long time ago. There has been some question for a number of years whether the operation should be called the Webster or the Baldy operation. As a matter of fact, Dr. Baldy has about as much right to have his name attached to this operation as Cook has a right to claim the discovery of the North Pole. There is no reason why the operation described by Dr. Webster should be called the Webster-Baldy operation.

It seems to me that these reports in regard to the ill-advisedness of this operation should be convincing to the most skeptical individual. An abdominal operation must be

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safe and simple; it must allow inspection of the contents of the abdomen; all of these requirements this operation does to a certain extent fulfil, except that of safety. Then it must use natural ligaments instead of false ligaments and must use the strongest part of the round ligament. The round ligament grows smaller and smaller toward the internal ring, and any operation that throws out the two-thirds of the anterior portion of the ligament throws out the very best part of the ligament we have for holding the uterus forward.

Dr. J. O. Polak, New York: This discussion has brought out just what I had hoped it would bring out—the results of some of the other observers. I felt that perhaps my results were due to faulty technic or a misconception of the principles of the operation, but they have been reported to you fairly. Dr. Reynolds made the point that anomalies of the uterus, such as the deep posterior invagination of the cervix, complicate retroversion work. We have found that no retroversion operation will cure patients of this class permanently, unless the cervix is placed and held backward toward the sacrum. I brought this point out some six years ago in a paper which I presented to the American Gynecological Society on the result of suspension of the uterus. It was only by the use of a pessary immediately after our suspension operations were done that we were able to present such excellent results in restoration of the uterus—results not obtained by other men with this operation. This was not because of the technic, but because we recognized that the cervix must be kept backward, and that, if this was done, the fundus would be maintained forward by intra-abdominal pressure. The pessary in a large number of cases did this mechanical act.

I am sorry that I gave the impression that I have condemned the Webster-Baldy operation. I have not. I am still using it occasionally, but am selecting the cases. These four hundred cases include all degrees of retroversion. We were doing the Webster-Baldy operation on the cases in which we removed a tube or an ovary or in which we were doing straight retroversion work. We are now selecting for this operation the small uterus with well-developed round ligaments, with few, if any, varicosities in the broad ligaments, and with a cervix that is not congenitally anteflexed.

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TUBERCULOUS SALPINGITIS

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FALL RIVER, MASS.

Tuberculous salpingitis is not a rare disease, but one which may advance to its worst stage without alarming symptoms. Its proportional frequency cannot be actually determined, inasmuch as the statistics of several authors show wide discrepancies. The literature on this subject, historical and synoptic, was thoroughly reviewed by J. Whitridge Williams[1] in 1892, and by John B. Murphy[2] in 1903, in an admirable essay on "Tuberculosis of the Female Genitalia." A comprehensive paper on "Tuberculosis of the Female Organs of Generation and the Peritoneum" was read before this Section in 1910 by J. Riddle Goffe.[3]

Williams, in ninety-one cases of perisalpingo-oöphoritis, found tuberculous tubes in 7.7 per cent. Penrose[4] reported its occurrence in 20 per cent. of a series of celiotomies for pelvic inflammatory disease. "The great frequency of general tuberculosis as a primary lesion in the fallopian tubes is shown in the statistics of W. Meyer,[5] who reports sixty-seven cases of primary tuberculosis of the genital tract, of which fifty-seven were primary in the tubes."

I have made an examination of the clinical reports of five large American hospitals, and find that tubal tuberculosis occurred approximately once in every 300 lapa-

1. Williams, J. W.: Johns Hopkins Hosp. Rep., 1892, iii, 85.
2. Murphy, John B.: President's Address, Chicago Surg. Soc., 1903.
3. Goffe, J. Riddle: Tr. Sec. on Obst. and Dis. Women A. M. A., 1910, p. 89.
4. Penrose: Am. Jour. Med. Sc., 1894, cviii, 520.
5. Meyer, W.: Diagnosis of Diseases of Women, Findley, p. 398.

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rotomies and about once in every seventy abdominal operations for pelvic disease. In a review of 1,500 abdominal sections, a few more than 600 of which were gynecologic, with the aid of a pathogolist, Dr. A. C. Macrae, I have recognized fifteen cases of tuberculous salpingitis. The youngest of these patients was 16 years old and the oldest 58; one was 52, one 42, two between 30 and 40, six between 20 and 30, and three between 15 and 20 years. Of this small series then 40 per cent. were between the ages of 20 and 30 years. While the disease is most common during the period of menstrual activity, no period of life is exempt. Williams cites the case of a patient of Brouardel who was 10 weeks old and another of Krzywicki who was 83 years old. Chaffey[6] described a case in which a child aged 4 died from tuberculosis of the abdominal organs. The tubes formed two nodular masses. Silcock[6] detected a similar condition in a child aged 5.

The fallopian tubes are much more frequently the seat of tuberculosis than any other part of the female genital tract. The infection is primary or secondary and nearly always bilateral. Adami[7] states that primary tuberculosis occurs in about 18 per cent. of all cases of genital tuberculosis in the female, and that the infection is probably always hematogenous. An occasional case does, undoubtedly, arise from the spermatic fluid containing tubercle bacilli. This, nevertheless, could explain only a small number, since the association of genital tuberculosis in the husbands of affected women is admittedly rare. Dr. Murphy's experiments on monkeys, relative to the avenue of invasion of the fallopian tube, have shown interesting and instructive phenomena. He observed that tuberculous material placed within the peritoneal cavity of the monkey gravitated into the pelvis and was not carried by the lymph-current and intestinal peristalsis in the direction of the diaphragm. The

6. Chaffey and Silcock: Tr. Path. Soc., London, 1885, xxxvi, 303.
7. Adami: Principles of Pathology, p. 846.

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mucosa of the tube was not infected nor was the adjacent musculature. The fimbriated ends of the tubes were agglutinated, and there had been no entrance of bacilli through the distal end of the tube. The most probable path of infection then is through the blood-stream, and its frequency there is attributed by most writers to faulty blood-supply. Amann, quoted by Murphy, in support of this theory points to the fact that from the ovarian artery two small branches are given off to the fimbriae and abdominal end of the tube, and that the territory between the tubal network of the uterine artery and that of the ovarian artery is poorly nourished. The fallopian tubes are tortuous and the arrangement of the mucosa in irregular folds, by retarding the secretions, favors the growth of tubercles. They are, therefore, anatomically predisposed to tuberculosis.

The pathologic process in tuberculous salpingitis does not differ markedly from that in chronic salpingitis. There is the essential distinction that the stroma in the tuberculous tube is not only the seat of round-cell infiltration, but it also shows giant cells and other characteristic deposits of tuberculous disease.

The researches of Schramm,[8] Munster and Orthmann[9] reveal the fact that in the early stage of tuberculosis of the tube it is the mucosa and adjacent tissue that are first attacked and salpingitis is the result.

The fimbriated extremity, as in other forms of salpingitis, does not become adherent to the ovary. The fimbriae are contracted and thickened, but unless there is a mixed infection the ostium remains patent for a longer period than in other forms of salpingitis. This appearance of the fimbriated extremity is typical of tuberculous salpingitis.

It is probable that in some instances a mixed infection exists from the beginning, inasmuch as previous inflammation renders the tube more liable to invasion by

8. Schramm: Arch. f. Gynäk., xix.
9. Munster and Orthmann: Arch. f. Gynäk., p. 97.

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the tubercle bacillus. The tube presents a characteristic appearance especially in the early cases in which there is a dilatation at the ampulla, the fimbriae are contracted, thickened, and yet free. The proximal end shows little enlargement, but a nodular irregularity is always to be seen in this portion of the tube, frequently occupying the area in which the musculature of the uterus and the tube merge. The peritoneum covering the pelvic viscera may or may not be studded with tubercles. In the later stage of the disease tubercles are usually disseminated over the parietal and visceral peritoneum. The disease in other respects resembles the advanced cases of pyosalpinx from other causes.

Tuberculous salpingitis is seldom recognized before the abdomen is opened. As in dermoid of the ovary, the diagnosis is made only as an expression of refinement. In fact, tuberculous salpingitis is not easily differentiated from dermoid. Both conditions occur in a class of patients very much alike. Virgins who have abnormalities in the broad ligaments are much limited to these two diseases. It is estimated that in virgins salpingitis is tuberculous in 90 per cent. of the cases.

It is essential to have tuberculosis in mind whenever a history is taken or reviewed, and the importance of family, social and occupational record will be less liable to escape. Tuberculous salpingitis pursues a course of unusual chronicity and in its early stage has few characteristics, yet it is vastly more important to discover this affliction than a chronic appendicitis, or a puerperal or neisserian salpingitis, for, like cancer, it has its curable and incurable stages. The presence of a tender swelling in one or both broad ligaments in a tuberculous subject is fair evidence of the disease, but tuberculosis is so frequently primary in the tube that we rarely have this association. Only one of my patients, a teacher of 21, presented this double process. The pelvic symptoms were acute and severe when I saw her. At operation,

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somewhat to my surprise, I found an advanced stage of tuberculous salpingitis. She died of phthisis one year later.

The constitutional symptoms are often mild, and the local symptoms are so insidious that patients rarely present themselves for examination during the early stages.

An evening rise of temperature of two or three degrees with a morning remission to normal or below generally accompany this form of salpingitis, especially in the transitional or later periods of the infection. As in tuberculosis elsewhere, the afternoon temperature is well borne, and often found unexpectedly high. The local symptoms, except during the menstrual period, are only occasionally severe and due to perisalpingitis. The abdomen is usually distended in some degree, depending on the extent of the disease. One of the most constant symptoms of tuberculous salpingitis is peritonitis, varying in extent from a local pelvic process to general diffuse peritonitis, characterized by distention of the abdomen and free fluid. Vaginal examination may reveal a bilateral tubo-ovarian mass, but this is of importance only in conjunction with other facts. The diagnosis has occasionally been confirmed by finding tubercle bacilli in smears from the cervical canal. In virgins a rectal examination can easily be made, and should be exercised on any suspicion of tuberculous tubes. As evidence of this importance I cite the following case:

Patient.—L. T., aged 18, single, was referred to me by Dr. A. C. Peckham, in March, 1913. Her family history was negative. Except for her inability to attend school on account of nervousness her past history was unimportant. She was then a mill operative and had been employed steadily for a year.

Symptoms.—For one month the patient had complained of intermittent pain across the lower abdomen with nausea. Her bowels were sluggish. She was well nourished and had good color. There was no evidence of pulmonary or glandular tuberculosis. Her afternoon temperature did not rise above 99 F. There was tenderness across the lower abdomen with some rigidity of the right rectus muscle. I did not make a rectal examination. The picture presented was consistent with a mild form of acute appendicitis.

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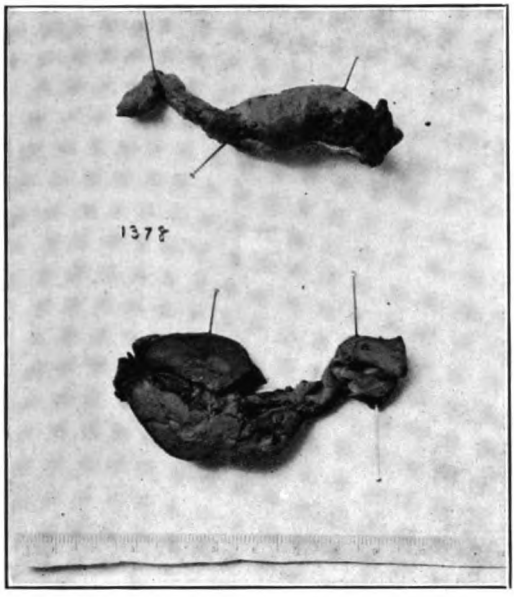

Fig. 1.—Tuberculous Salpingitis, early stage, showing greatest enlargement at the ampulla and free fimbriated end; the opposite tube in longitudinal section showing complete occlusion of lumen by tuberculous products.

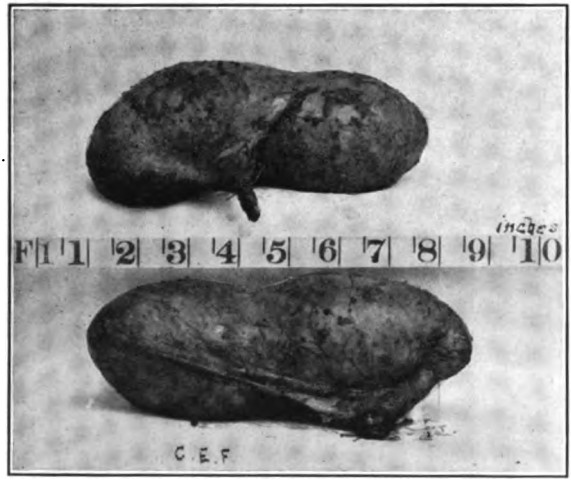

Fig. 2.—Tuberculous salpingitis, advanced stage, showing enormous enlargement of the tube with occlusion. These tubes resembled large cucumbers and were entirely free from adhesions.

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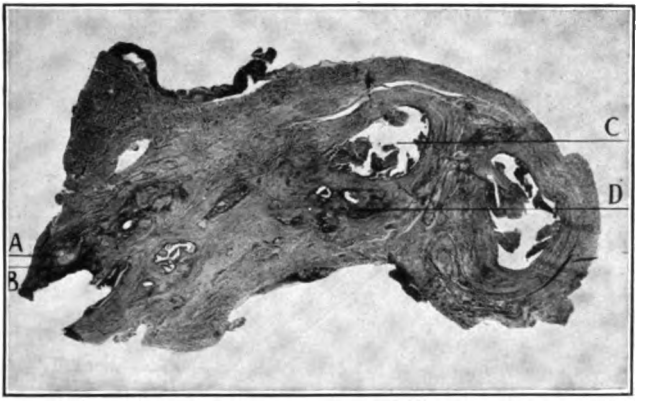

Fig. 3.—Longitudinal section of tube extending into uterine cornu, (*b*) miliary tubercle and (*a*) caseous tubercle in uterine muscle, (*d*) clump of miliary tubercles in musculature of tube, (*c*) lumen of tube.

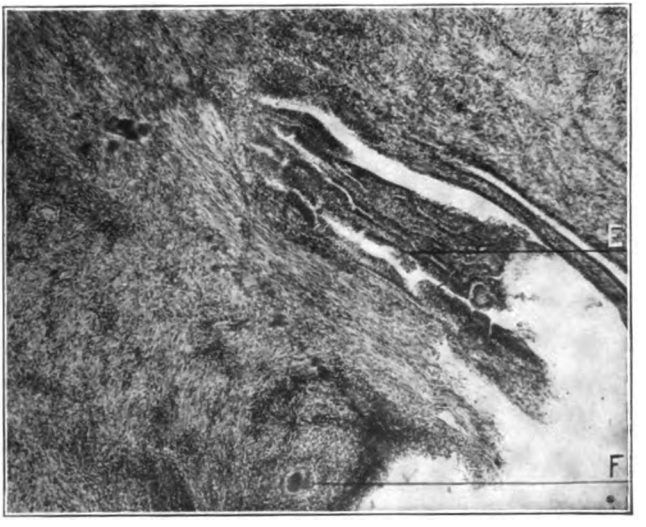

Fig. 4.—Low-power view showing (*e*) mucosa of uterine cornu, (*f*) miliary tubercle with central giant cell.

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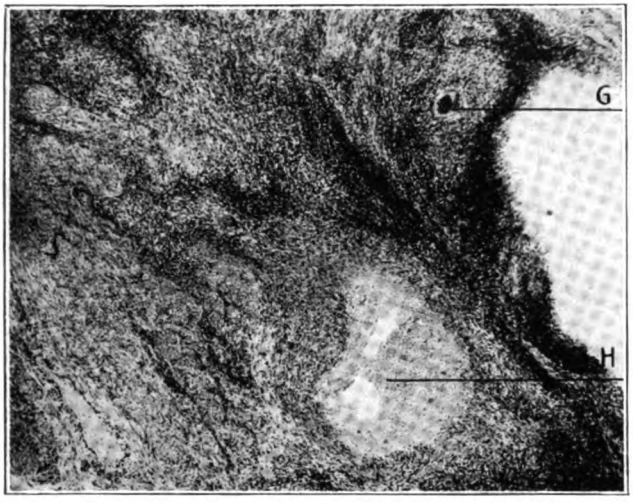

Fig. 5.—Low-power view, uterine muscle with (*g*) miliary tubercle, (*h*) caseous tubercle.

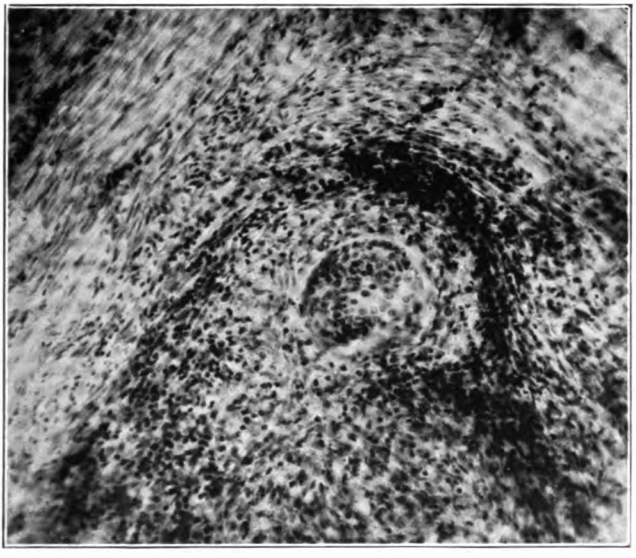

Fig. 6.—High-power view, tubercle with giant cell near uterine end of tube.

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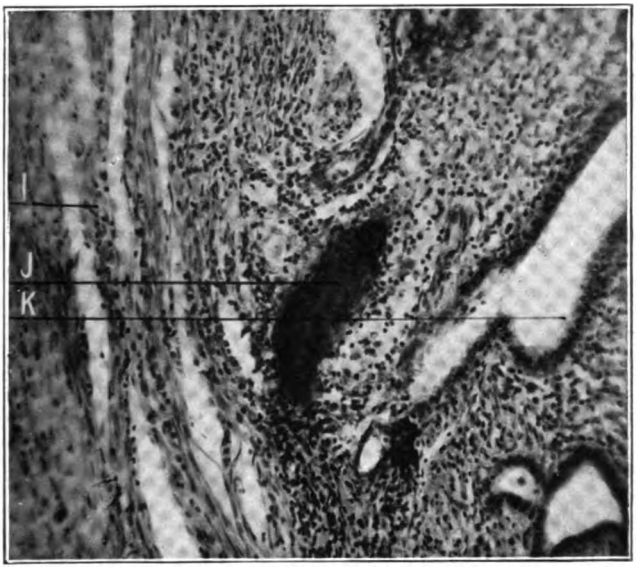

Fig. 7.—High-power view, section of tube (*i*) muscle, (*j*) giant cell in submucosa, (*k*) folds of mucosa with normal epithelium.

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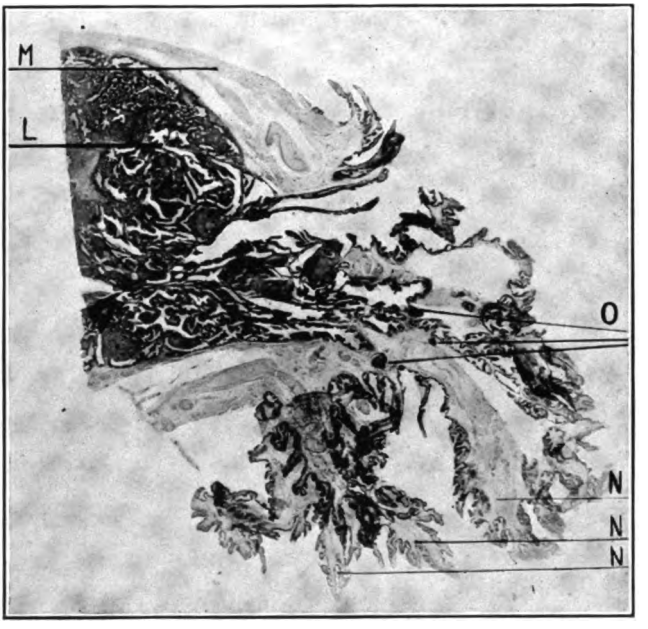

Fig. 8.—Low-power view, longitudinal section of fimbriated end of tube. (*l*) lumen occluded by tuberculous products. (*m*) thinned out wall, (*n*) free ends of fimbriae, (*o*) three miliary tubercles.

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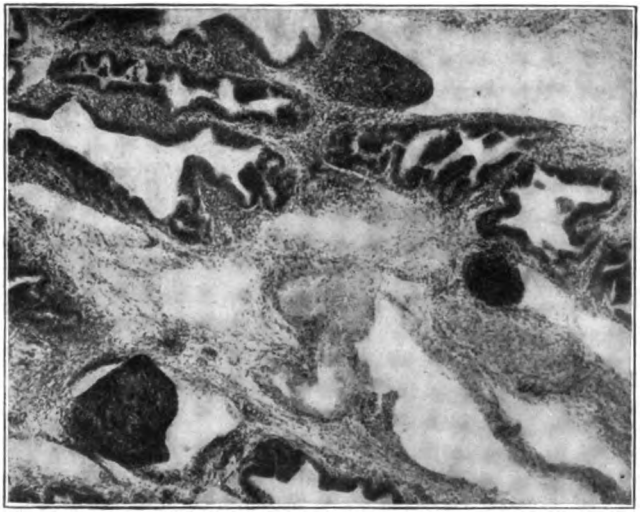

Fig. 9.—High-power view of same three tubercles as in Fig. 8 (*o*).

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Operation.—The appendix was delivered through a McBurney incision and would have explained the symptoms satisfactorily had it not been for the presence of a clear, free fluid which a little more than filled the pelvic cavity. There were no miliary tubercles on the parietal or visceral peritoneum near the incision or around the iliocecal valve. Further investigation, however, revealed a small segment of the ilium in the pelvis studded with tubercles and the primary seat of the tuberculous process was found in the tubes. A median incision was made and both tubes resected.

In this case a rectal examination would have confined the operative procedure to one incision.

The diagnosis must be made from the history and the evidence obtained from physical examination. The tuberculin tests are often misleading. The von Pirquet reaction failed to appear in one of my patients who had large tuberculous tubes. There are other factors which militate against the use of these tests, not the least important of which is the inclination to attach too much significance to the result. On reasonable suspicion of tuberculous salpingitis the abdomen should be opened. The curability of this disease by a simple early operation, when viewed in contrast with its potential dangers, should have a compelling influence in favor of direct inspection. The early operation is simple enough in comparison with the problem accompanying a bilateral tuberculous pyosalpinx which has become firmly adherent to surrounding structures.

Few lesions in the female pelvis are more alluring than this adherent form of tuberculous salpingitis. A laceration into the lumen of the intestine under such circumstances may well cause apprehension, since it is difficult to repair, unlikely to unite, and a temptation to employ drainage in some form. A union of the tubal mass with the bowel that is firm and dense should not be disturbed. Occasionally the process of necrosis has penetrated the wall of the intestine, and only the contact of the tube itself prevents a perforation, or the ulceration

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may have perforated the contiguous walls and established a communication of the intestinal lumen with that of the tube.

One who has time and again successfully extirpated the uterine appendages for old, dense, inflammatory lesions of other forms is loath to retreat because the disease, no more extensive, is now tuberculous. With more precise knowledge of the pathologic changes in advanced cases, nevertheless, we are prepared to make allowance for a more vulnerable and irreparable surrounding structure. The forcible separation of a tuberculous tubo-ovarian mass carries with it definite risks: (*a*) hemorrhage; (*b*) the liberation of a mixed infection, and (*c*) intestinal fistulas. Hemorrhage is of little consequence unless it is found necessary to employ a gauze drain to control a persistently oozing surface, whereupon the liability to a mixed infection and fistulas is increased manifold.

Intestinal fistulas resulted in two of my patients after the use of drains. One patient died six months after operation, after repeated hemorrhages from the sinus. The second patient, as reported before, died of phthisis one year after operation. Her fistula never healed.

The failures after drainage have been emphasized by most writers, and the universal practice now holds to complete closure of the celiotomy wound even though some purulent material has escaped from the tube during extirpation. When the question of drainage arises, unless the infection is of a mixed type and acute, one should take the risks against its use. Our reluctance to close the renal fossa without drainage after nephrectomy for renal tuberculosis has been shown to be a fallacy. Likewise, in pelvic tuberculosis the use of drains, especially gauze, is not a measure of safety, but a distinct hazard.

Failure of the abdominal wound to heal by first intention is frequent after operation for tuberculous salpingitis. This is probably due to insufficient protection of the wound during the operation. The entire margin of the

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wound should be covered with pads of gauze and sponged with iodin or a 70 per cent. solution of alcohol during closure. These simple precautions will minimize the percentage of infected wounds.

The treatment of tuberculous salpingitis, therefore, is surgical. Spontaneous recoveries have undoubtedly occurred. Goffe mentions one case. Kussmaul in 1899 witnessed recoveries in several cases of tuberculous peritonitis, some of which must have been of tubal origin. The rarity of a correct early diagnosis without laparotomy, however, is universally admitted. The knowledge which we possess of therapeutic measures in their relation to cause and effect is, therefore, of little value.

Cure has followed simple laparotomy with removal of the fluid, perhaps by allowing the fimbriated extremity to be closed by adhesions to the surrounding peritoneum. In addition, this operation has established the diagnosis whereupon the best principles of hygiene are adopted and the progress of the disease arrested. Not always, however, for William J. Mayo[10] reported seven cases in which previous laparotomy had been done from one to four times. He cleared up the disease in these cases by removal of the fallopian tubes. This emphasizes the fact that tuberculous peritonitis nearly always is a symptom which should lead the surgeon to investigate further for the original source of infection.

The operation should deal radically with the original focus. Both tubes should be excised, taking with each a liberal section of the uterine cornua.

Whenever tuberculosis has involved the fallopian tubes the uterus should not be left if menstruation has ceased. The menstrual activity of this organ appears to be a factor in the prevention of its invasion by tuberculosis. Consequently, this function should be preserved whenever possible. In young adults, both ovaries should not

10. Mayo, Wm.: Surgical Tuberculosis in the Abdominal Cavity with Special Reference to Tuberculous Peritonitis, THE JOURNAL A. M. A., April 15, 1905, p. 1157.

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be removed. If the extent of the disease demands a bilateral salpingo-oöphorectomy, hysterectomy should also be done.

The surgical risk is increased during the acute stage. It is much safer to postpone operative measures when the temperature is persistently above normal during the twenty-four hours. If the temperature shows an evening rise a daily morning remission to normal, delay is unnecessary.

The results of surgical treatment in the early cases of primary tuberculosis of the tubes are uniformly good. In the more advanced adherent form of mixed infection the outcome usually depends on the character of the risk and the individual equation of the operator. Seldom is the courage to retreat more happily rewarded than in some of these cases.

Of the fifteen patients on whom I operated, one died ten days after operation from an acute, general tuberculous infection. One died six months after operation of repeated hemorrhages from a sinus which persisted after the use of drainage. In another drainage case the patient lived one year without closure of the wound; pulmonary tuberculosis caused her death. Two patients are reported to be in poor health. One whose wound was closed at the time of operation, but reopened and discharged for about six months, remained in fairly good health for three years. She is now in a distant city where she had a laparotomy done three months ago, probably for a recurrent peritonitis. Drainage was employed and the result is reported to be disappointing. Another patient, who is now in Canada, states that her wound has healed, but she has not regained her health. The remaining ten patients are free from any further manifestations of tuberculosis.

In summarizing the preceding, these observations are worthy of emphasis:

1. Tuberculous salpingitis most frequently attacks young adults.

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2. It is frequently the only focus of tuberculosis to be demonstrated in the patient.

3. Tuberculous peritonitis is a secondary manifestation and should be so treated.

4. The application of surgery in the advanced cases should be conservative and without the use of drainage.

5. Removal of the fallopian tubes should be followed by a life based on the best principles of hygiene.

130 Rock Street.

ABSTRACT OF DISCUSSION

DR. D. C. BALFOUR, Rochester, Minn.: I wish to emphasize two or three points. In the first place, regarding the age of the patient: Of the cases in our service over one-half of the total number occurred between the ages of 20 and 30 and over one-sixth between the ages of 15 and 20. In the second place, I would note the great frequency with which this condition is unsuspected and the patient subjected to operation for the relief of symptoms which are supposedly due to lesions elsewhere in the abdomen. In looking up the records, I found that in the past five years there have been found at operation about sixty-seven cases of tuberculous salpingitis, and of these twenty-six, or 39 per cent., were previously definitely diagnosed as tuberculous salpingitis; twenty, or about 30 per cent., were put down as pelvic inflammation, and 31 per cent. were diagnosed as being due to other trouble in the abdomen. There was no suggestion that any trouble in the pelvis was suspected. I would emphasize the importance of remembering that in tuberculous peritonitis in women the tubes are practically always the source of the infection, and the extirpation of these foci of the disease, if it is possible, will be followed by most excellent results. I would further draw attention to the danger and risk of introducing drainage in these cases. On account of the peculiar, inflammatory condition of the adjacent loops of intestine, the occurrence of a fistula is rendered extremely liable, and should it occur, the difficulty, and in many cases the impossibility, of closing it is well known.

DR. CURTIS S. FOSTER, Pittsburgh, Pa.: This is a subject that has interested medical men and surgeons since Sir Spencer Wells did the first laparotomy for tuberculous peritonitis in 1862. It is of interest, first, because we do not have any definite pathognomonic symptomatology of the disease, but a disease which runs a course varying in different persons from a sharp, clinical picture confined to the peritoneum alone to one occurring extensively and yet so quietly as to pass unno-

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ticed owing to more fulminant infections in other organs. In the second place, there has always been a mystery concerned with the recovery of these patients until we found out that when we removed the focus of the disease the peritonitis was cured. Because of the close relation of the peritoneum, we can hardly discuss the subject of tuberculous salpingitis without considering also tuberculous peritonitis. While Murphy's experiments on the monkey showed that gravity played an important part in the dissemination of tuberculous peritonitis, yet Murphy did not consider that the tubes were not infected in the human being by gravity and by tuberculous germs coming down from the peritoneum above. I do not think that the majority of infections of the tubes in tuberculous salpingitis are hemic in origin. Unless the tube is occluded by the severity of the inflammation there is no doubt that the tuberculous process can extend to the tube and set up tuberculous inflammation of the mucous membrane. In the treatment of these cases we therefore have four objects in view: First, we must shut off the original focus of infection. We do that by taking out the tube. Secondly, we must remove the products of the infective process from the peritoneum, so far as possible. Thirdly, we must aid in the encapsulation of the remaining focus or foci, and, fourthly, we must avoid mixed infection.

I think that drainage is a pernicious procedure and it is being relegated to the past by almost every surgeon. I could hardly agree with Dr. Truesdale that we should drain even in mixed infections. One of the objects in our work is to avoid mixed infection. I do not think that we can drain a tuberculous peritonitis for any length of time without getting a mixed infection. In these cases in which the tube is at fault, in which it is pouring out its debris into the peritoneum, we remove the tube and close the abdomen. These are the serous cases and they give the best results, but we obtain almost as good results in a mild mixed infection when we close the abdomen tightly without drainage. I would not agree, therefore, that we should drain in any mixed infection, except in cases of what might be called a sudden infection, that is, when the tube with a mixed infection has ruptured into the abdomen, or when there is ruptured appendix or ulcer of the bowel. In these cases the mixed infection is the dominant infection. In a mixed infection of the peritoneum which has occurred slowly and in which the process has been walled off I would consider drainage reprehensible.

DR. J. H. CARSTENS, Detroit: There are a few points about peritonitis that always interest me. With tuberculous peritonitis the tube is filled with tubercles; on that tube and studding the whole peritoneum there are many tubercles; you cannot put your finger on any part of the peritoneum on which there is not a tubercle. All of those tubercles disappear

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and take care of themselves. Why then, would not the few tubercles on this innocent little tube disappear also? They do; and I strongly object to the removal of the tubes, especially in young women, because I know that these tubercles will disappear.

The only reason for removing a tuberculous tube is the presence of a mixed infection when the tube is filled with pus, streptococci and staphylococci. As a general rule, however, if examination of the blood, etc. is made beforehand, it is not found necessary to remove the tubes. So I say, let the tubes alone. Do not sterilize that young woman.

We remove an appendix with a tuberculous condition, not because we are afraid of the few tubercles on the outside of the appendix, but because we know that the appendix itself may become inflamed. I have tried all these procedures, and I say "Do not drain." Some drain by *en masse* suture, and along that silkworm suture bacilli develop and appear on the outside. Sew up the wound with simple catgut. Do not sew the skin; just bring it together and put on a little adhesive plaster.

Dr. John B. Murphy, Chicago: Dr. Carstens has made some statements which I heartily endorse, and others, concerning the spread of the disease from the primary focus, which are not in consonance with my observations. What is the lesion? Where is the primary focus of the disease? How does it cause the destruction? We do not know just how the tubercle bacilli arrive in the tube. Tuberculosis is not a disease of the surface of the tube; it is primarily a disease of the mucosa of the tube, and the tubercles that we see on the surface are the secondary peritoneal deposits of the tuberculous process. It is a tuberculosis of the mucosa of the tube and does not appear as a tuberculosis on the surface of the peritoneum of the tube, except as a secondary or advanced manifestation. There is no tissue in the abdominal cavity so resistant to tuberculosis as the peritoneum. There is one tissue in the abdominal cavity, and only one, that has a lesser resistance to tuberculosis and a lesser tendency to repair than the tube, and that is the mucous membrane of the intestine. The lesion under consideration is a tuberculous infection of the mucosa of the tube, with secondary peritonitis. What is the clinical course of this disease? How does the peritoneum become infected? Not through the wall, but by expulsion of the tuberculous débris and bacilli from the end of the tube. The primary focus is the mucosa of the tube. The fimbriated end of the tube always remains open in tuberculosis, except when there is a mixed infection. From the recurrent expulsions of the tuberculous debris we have repeated attacks of acute inflammations in the lower abdomen resembling recurrent attacks of appendicitis. To cure that disease, when we have a simple or mixed infection of the tube all of its mucosa

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must be removed into the cornu of the uterus. In rare instances the tuberculosis ruptures through the wall of the tube and thus infects the pelvic peritoneum. Again, with a tuberculous ulcer in the tube, we occasionally find the peritoneal surface of the tube at the base of the ulcer studded with fine miliary tubercles. It goes without saying that we never drain a tuberculous process, except in the conditions mentioned, when it communicates with the intestine and we have a tuberculous intestinal fistula. If we produce an intestinal fistula in our operations, in the largest percentage of the cases we shall be unable to secure a closure.

Dr. J. H. Carstens, Detroit: Dr. Murphy, how do you get the tubercle in the peritoneum when it starts at the appendix? There is no mucosa there?

Dr. John B. Murphy, Chicago: The tubercle bacilli are transmitted through the wall of the appendix along the lymphatics to the surface and to the peritoneum. Tubercle bacilli are transmitted through tissues of the body to a much greater degree centripetally, however, than centrifugally. When the fimbriated end of the tube is closed the tuberculous process may rupture through the wall and thus infect the peritoneum and produce a paratubal tuberculous abscess. The appendix also occasionally ruptures and produces a para-appendical or perityphilitic tuberculous abscess. Neither of these often leads to general pelvic peritoneal tuberculosis, but they become circumscribed mixed infected granulomas.

Dr. P. E. Truesdale, Fall River, Mass.: The microphotographs which I have shown were made from sections of the fallopian tubes of a virgin manifesting the disease in an early stage. The pathologic process began in the mucosa of the ampulla and its extension could be easily followed precisely after the manner described by Dr. Murphy.

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OPERATIVE TREATMENT OF CANCER OF THE STOMACH

WILLIAM J. MAYO, M.D.
ROCHESTER, MINN.

The surgical treatment of cancer of the stomach compares favorably in results with the treatment of cancer of any other organ in the human body. When it is taken into consideration that nearly one-third of all cancers occur in the stomach and that their early discovery is a necessary factor in the cure of the disease, the necessity for a clear conception of the value of the various signs and symptoms is at once manifest.

With the hope of obtaining some definite information on these important points, an investigation was made in our clinic of the histories of a thousand patients submitted to operation for cancer of the stomach. These operations were performed between Jan. 1, 1894, and Dec. 31, 1912. For purposes of study they have been classified as follows: resections, 378; palliative operations, 246; explorations, 376.

The diagnosis of cancer of the stomach cannot often be made early enough to obtain a radical cure by operation, but a diagnosis of some condition of a surgical nature, probably cancer, can be made in time to permit operative interference in more than one-third of all cases (378 out of 1,000). The early diagnosis does not depend on any sign or symptom due to the cancer itself, but on the mechanical conditions produced by the growth. Therefore, in cases of suspected cancer of the stomach the recognition of such mechanical conditions should be the first aim of the diagnostician.

A probable diagnosis can be established by simple

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methods. In 67 per cent. of the total number of cases in this series tumors, some of which were of considerable size, could be palpated. The idea prevalent in the past that finding a tumor indicated an inoperable condition has been proved a mistaken assumption. A movable tumor is a favorable condition, especially if accompanied by early obstruction. We have a number of cases on record of patients who were operated on after a tumor was discovered, who are alive and well after a number of years.

Food remnants in definite amounts were found in 53.3 per cent. of the series, and gross obstruction was present in 20 per cent. Since more than 50 per cent. of all patients with cancer of the stomach have food remnants, it will readily be seen that, next to tumors, food remnants are the most important sign, not necessarily of cancer of the stomach, but of mechanical obstruction. A combination of tumor and obstruction is nearly pathognomonic of cancer in every case otherwise suspicious, and these two easily obtainable signs are of the first importance. Tumors, if present, are usually palpable and obstructive. At least 75 per cent. of cancers of the stomach have their origin in the pyloric end, a situation in which diagnostic conditions develop early. In this connection loss of weight is an important sign; the average loss in this series was 30 pounds.

Cancers of the body and fundus of the stomach occur in about 25 per cent. of all cases. When located at the cardia these growths produce early obstruction, but are not as yet surgically removable. In the body of the stomach but few can be diagnosticated sufficiently early to permit operation, because they are situated behind the margins of the ribs where a tumor cannot be palpated until a late stage, and, because of the wide gastric lumen, obstruction is a late development. In the few cases we have been able to diagnosticate early enough to warrant operation the patients were thin and gastroptosis was present, which made a tumor palpable.

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The evidence furnished by the Roentgen ray is next in importance to the discovery of tumor and food remnants. It is a valuable aid in the diagnosis, not because it demonstrates in the early stage that cancer is present, but because it shows deformities and muscular deficiencies that are evidences of cancer. It is also of great importance as a means of elminating from the operative group those advanced tumors of the body and fundus of the stomach which lie concealed under the ribs, and which have already progressed beyond the reach of surgical aid. The Roentgen ray also gives valuable confirmation as regards the presence of obstruction and tumor in cases of cancer of the pyloric end of the stomach.

The examination of the contents of the stomach during the curable period of the disease is of relative value, but is not pathognomonic.

For purposes of comparison, an investigation has been made in our clinic of a thousand cases of ulcer of the stomach and duodenum in which operation has been performed within the last six years (from Jan. 1, 1907, to Dec. 31, 1912). There was an average total acidity in these cases of above 63, more than five-sixths of which was free. In the thousand cases of cancer of the stomach, there was an average total acidity of 31, about one-third of which was free. These data bear out the accepted hypothesis that low acidity and especially low free hydrochloric acid content is indicative of cancer of the stomach. Low acidity, however, may be found in a large variety of conditions, but one fact was noted particularly, that is, a cancerous stomach always contained some acid although the free hydrochloric was often absent. The more advanced the case the lower the acidity and the less the free acid content. Lactic acid was found in 43 per cent.

Blood in some form was found in 73 per cent. of the cases. Severe hemorrhage from the mouth occurred in 4 per cent., coffee-ground vomit in 6.25 per cent., and hemorrhage from the bowel in 9 per cent. Occult blood

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in the stool was the rule. Occult blood is present, however, in so many conditions other than cancer of the stomach that its value as a positive sign is not great. Smithies[1] states that the Oppler-Boas bacillus was demonstrated in 93.8 per cent. of the last 146 cases of gastric cancer observed in our clinic. These figures were obtained by oil immersion of smears stained by the colored agar method.[2]

The gastroscope has not yet been perfected for practical use, although a great deal of experimental work has been done with the instrument (Jackson,[3] Plummer,[4] Janeway[5] and others) which promises well for the future.

A history of gastric disturbance precedes cancer in a large number, if not the majority, of cases. The average duration of symptoms in the series of one thousand cases was more than two years. This would indicate that in at least the majority of cases of cancer of the stomach, some lesion, ulcerous or otherwise, existed previous to the development of cancer—a point which has been disputed so far as cancer of the stomach is concerned, although accepted for all cancers on the surface of the body, where, so far as we know, cancer has never developed without a previous lesion. In an investigation by Wilson and MacCarty[6] of 218 cancers of the stomach removed by operation in our clinic, it was found that ulcer or some primary lesion of a similar character had existed in more than 50 per cent.

The art of the diagnostician lies in weighing the

1. Smithies, Frank: The Significance of Gastric Ulcer with Respect to Gastric Cancer. A Study of 566 Consecutive Operatively and Pathologically Demonstrated Cases of Cancer of the Stomach, THE JOURNAL A. M. A. (to be published).
2. Smithies, Frank: A Method for the Microscopic Examination of Gastric Extracts and of Feces, Arch. Int. Med., June, 1912, p. 736.
3. Jackson: Tracheobronchoscopy, Oesophagoscopy and Gastroscopy, 1911.
4. Plummer: Quoted by Jackson, see footnote 3.
5. Janeway: The Relation of Gastrostomy to Inoperable Carcinoma of the Esophagus, with a Description of a New Method of Performing Gastrostomy, THE JOURNAL A. M. A., July 12, 1913, p. 93.
6. Wilson and MacCarty: Am. Jour. Med. Sc., December, 1909.

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evidence at hand, and it is the rule that a correct diagnosis, if made at all, will be made on compartively few signs and symptoms of definite value. The presence of tumor and obstruction, supplemented by roentgenoscopy and the examination of the contents of the stomach indicates the lines of investigation. The exploratory incision is the final test and on the diagnostician devolves the difficult task of determining which of the patients shall submit to such procedures. To give the patient a fair chance exploration must be done early.

Under present conditions the patient who is submitted to exploration with a probable diagnosis of cancer of the stomach has a little over one chance in three of a radical operation, a little less than one chance in three of a palliative operation and about one chance in three that the operation will be merely an exploration.

Every operation for cancer of the stomach should begin as an exploration. Exploratory operations for cancer of the stomach are not devoid of danger to the patient. In the 376 explorations in our series of one thousand in which nothing further was done, there were six (1.6 per cent.) deaths. In none of these cases, however, could the exploration be considered the direct cause of death. In most of the fatalities the disease was far advanced, a fact that we had failed to estimate correctly.

In cases of suspected cancer of the stomach it is the practice in our clinic to make a small incision in the epigastric midline, opening the peritoneum to the left of the suspensory ligament of the liver. The stomach and accessible portions of the liver are examined with two fingers. In a certain percentage of cases the hopeless nature of the condition will immediately be seen and the wound can be closed at once with buried sutures of linen or silk. This enables the patient soon to return to his family and friends. An exploration of this nature can be conducted under local anesthesia with novocain and the patient disturbed but little. In a large number of cases, however, such explorations are inade-

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quate and the incision must be enlarged sufficiently to introduce the hand in order to make a more careful survey of the stomach, omenta, liver and peritoneal cavity. In such explorations the traction on the wound will ordinarily cause enough pain to make the use of ether advisable.

If, on exploration, a resection is deemed possible, the portion of the stomach containing the tumor is withdrawn from the abdominal cavity for further inspection. This examination will include the transverse colon and mesocolon. Occasionally the transverse mesocolon is involved in the arcade between the main branches of the middle colic vessels, and the portion involved can be removed without endangering the vascular integrity of the transverse colon. In a few instances in cases otherwise favorable for operation, the transverse colon was also involved and we then resected the diseased portion of the stomach with the involved transverse colon attached. One question rather difficult to decide is, what action to take when the disease in the stomach is mechanically removable, but infected lymph-nodes exist which are not removable. If such patients are in fair condition and the operation can be done without too great risk, we perform a resection. The resulting one or two years of comfortable existence for the patient seems to justify the action.

Moderate involvement of the pancreas does not necessarily preclude operation. Involvement of the pancreas has been considered a bar to resection of the stomach, but we have satisfactorily removed superficial portions of the pancreas in over 8 per cent. of our resections, closing the end of the duodenum with purse-string sutures and implanting it into the excavation in the pancreas (Meyer[7]). Leakage has not occurred from either the pancreas or the duodenum, and altogether the technic has been most satisfactory. In our earlier work we were much concerned over the possible outcome of these pro-

7. Meyer: Tr. Am. Surg. Assn., xxviii, 1910, p. 329.

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cedures, since Haberkant[8] and Mikulicz[9] had shown a mortality of 70 per cent. or more in like cases. In reviewing our cases, however, we have not found that the mortality was increased more than 1 per cent. as a result of these complications.

Enlarged lymph-nodes will be found in a high percentage of cases of cancer of the stomach, but are not always malignant. The relative degree of involvement may be noted as follows:[10] (1) the group along the lesser curvature; (2) the inferior pyloric group; (3) the group along the greater curvature, and (4) the superior pyloric group. Early ligation of the four blood-vessels acts as a starting point for the separation of the lymph-nodes.

With some exceptions the restoration of the gastro-intestinal tract can be best affected by the Billroth No. 2 method, that is, complete closure of the ends of the duodenum and stomach with an independent gastrojejunostomy, preferably by the posterior route. If the remaining pouch of the stomach be small, however, anterior gastro-enterostomy appears to answer the purpose equally well and is easier of performance.

In some cases of extreme malnutrition it may be advisable to do a gastrojejunostomy to be followed by a resection in two or three weeks, when the patient is in better condition. We have practiced this method occasionally, but, if the case is otherwise favorable, we prefer to make an immediate resection because it disposes of a foul, sloughing mass in the stomach, and the risk in doing the complete primary operation is little, if any, greater than in doing the operation in two stages. Palliative operations on the stomach are of some value but they should not be performed except for the relief of mechanical conditions, such as obstruction or, occasionally, when a differential diagnosis between ulcer and

8. Haberkant: Quoted by Paterson: The Surgery of the Stomach, p. 43.
9. Mikulicz: Tr. Cong. Am. Phys. and Surg., 1903, vi, 55.
10. MacCarty, W. C., and Blackford, J. M.: Involvement of Regional Lymph-Nodes in Carcinoma of Stomach, Ann. Surg., June, 1912, p. 811.

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cancer cannot be established. In an occasional case perforation of an ulcer with adequate peritoneal protection occurs, but whether it is benign or malignant cannot be determined. If malignant, it cannot be removed, and the operation will be palliative; if benign, a cure results.

Gastrostomy is often a valuable operation in cancer obstructing the cardiac end of the stomach. It should be made with a No. 16 English catheter and preferably by the Witzel method. We performed this operation in a number of instances with a small catheter, about No. 8 or No. 9 English, fearing leakage, but we have gradually acquired confidence in the use of the larger size, which permits greater range of dietary. Pierce Gould[11] has called especial attention to the value of a No. 18 English catheter is gastrostomy.

In pyloric obstruction an anterior gastrojejunostomy after the method of Wölfler[12] and Hartmann[13] is the operation of choice since it can be accomplished with less manipulation than is necessary to reach the posterior wall of the stomach in order to perform the posterior operation. In our experience a vicious circle has not followed this plan, and the average mortality has been a little more than 4 per cent. We have had a somewhat higher mortality following the posterior gastrojejunostomy for malignant disease, evidently due to the increased manipulation.

Jejunostomy is occasionally a valuable method in cases of cancer of the stomach, especially in those high posterior perforations in which a radical operation is not possible. The involvement may be so high on the stomach that a gastrojejunostomy cannot be done on the proximal side, and in some cases it cannot even be determined whether or not the ulcer is benign or malignant. The jejunostomy is usually made from about 12 to 16 inches down from the origin of the jejunum by the

11. Gould, A. P.: Treatment of Inoperable Cancer, Lancet, London, Jan. 25, 1913, p. 215.
12. Wölfler: Centralbl. f. Chir., 1881, No. 45.
13. Hartmann: Arch. gén. de méd., 1900, iii, 562.

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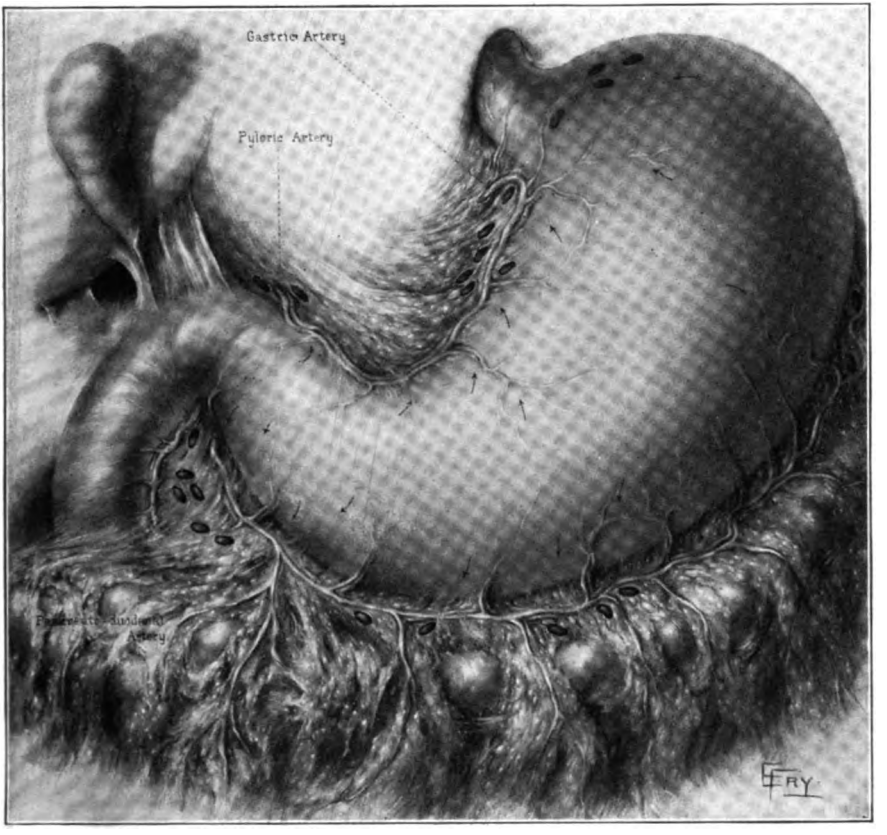

Fig. 1.—Distribution of the lymph-vessels of the stomach.

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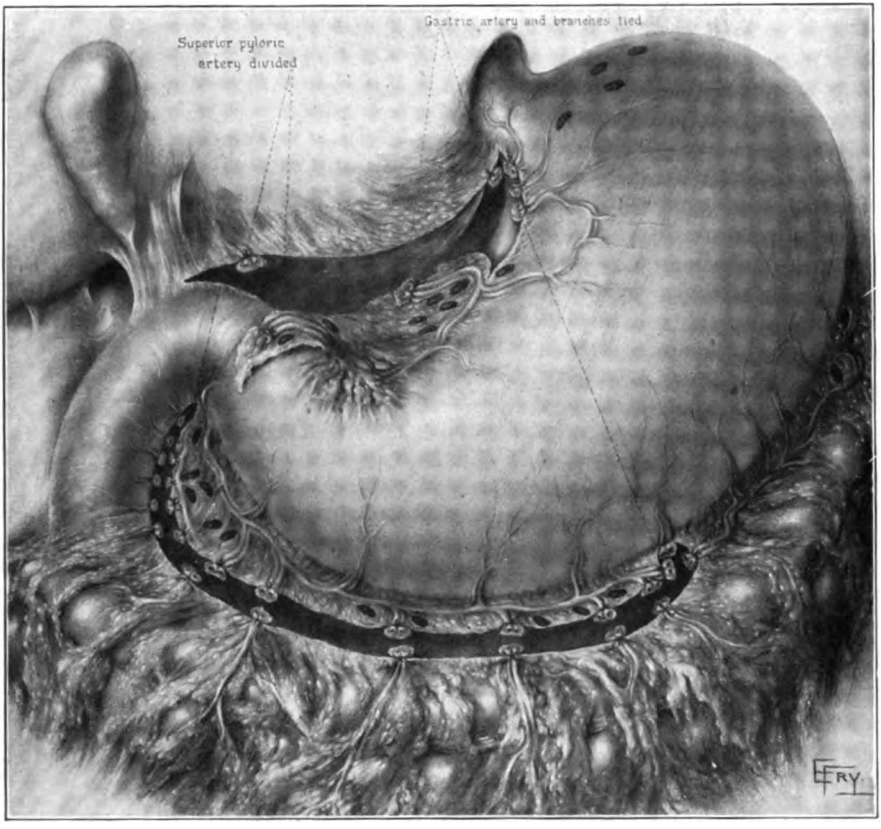

Fig. 2.—Carcinoma of the lesser curvature of the pyloric end of the stomach, with separation of the lymphatic groups. Dotted lines show proposed resection.

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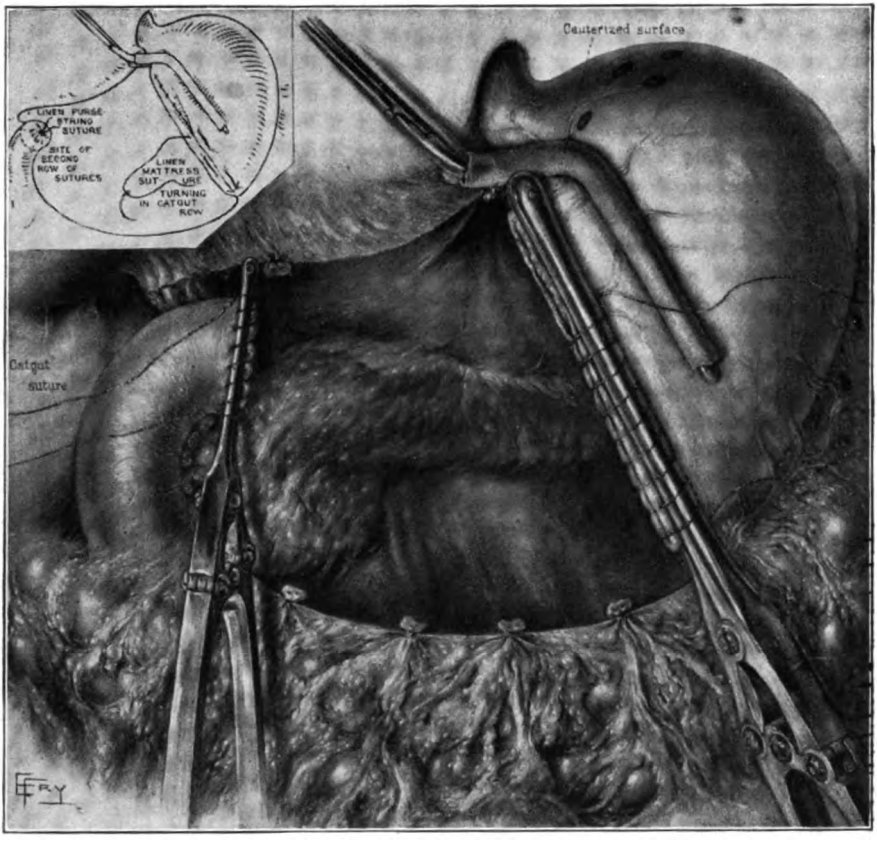

Fig. 3.—Method of closure of the ends of stomach and duodenum by continuous chromic catgut suture, to be followed by musculoperitoneal suture of linen (see small diagram).

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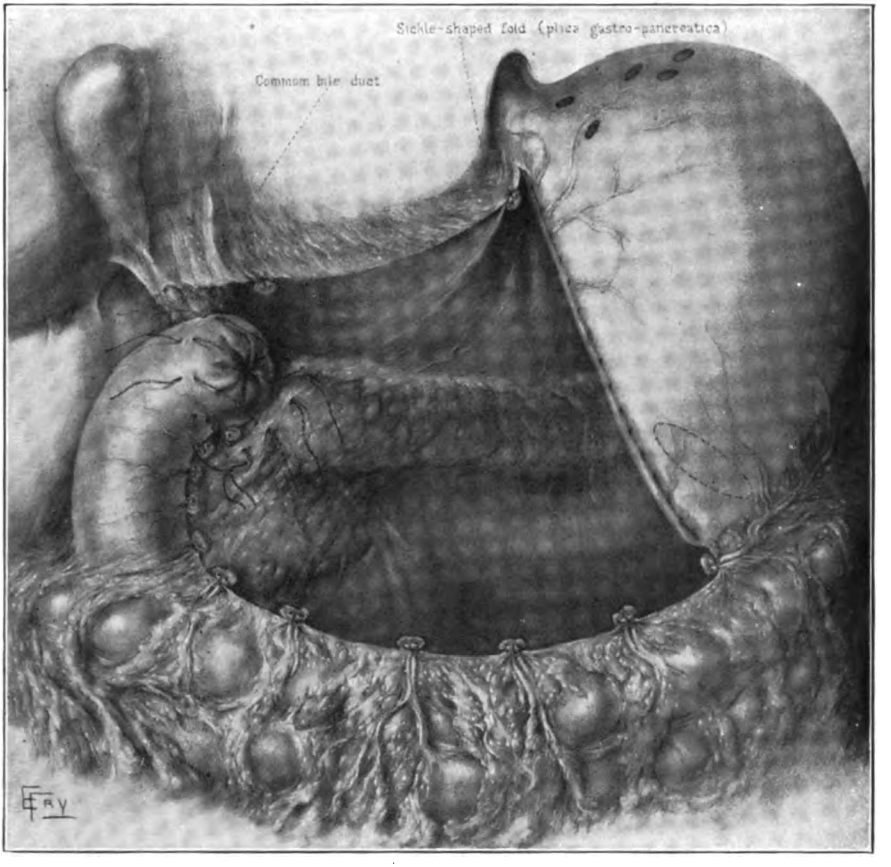

Fig. 4.—Interrupted sutures tying stump of duodenum to pancreas. Dotted lines show posterior gastro-enterostomy.

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Witzel method and using a No. 12 English catheter. We have had no leakage in these cases, nor has the attachment of the jejunum to the abdominal wall been a cause of later trouble. Jejunostomy, in cases of either ulcer or cancer, affords adequate feeding and gives complete rest to the involved stomach. If the condition be ulcer, the improvement in nutrition is almost as valuable as rest in stimulating the healing process. A rapid gain in weight and strength is the rule in these cases. The operation is also of great value in cases of accidental injury during the exploration of a cancerous stomach in which resection cannot be done.

CONCLUSION

It may be said that with our present means of diagnosis, cancer of the pyloric end of the stomach can be recognized sufficiently early to perform the radical operation in at least half the cases. The mortality is about 10 per cent., depending largely on the class of cases accepted for operation. If an early diagnosis has been made and the patient is in good condition, the mortality will be less than 5 per cent. There is a prospect of a five-year cure in about 25 per cent., and of a three-year cure in 38 per cent., in the case of those who recover from the operation. Comparatively few patients who recover following resection fail to get more than one year of relief.

ABSTRACT OF DISCUSSION

DR. WILLIAM L. RODMAN, Philadelphia: There are forty thousand deaths from cancer in the United States every year, and, if we accept the statement of that conservative pathologist, Virchow, even a larger percentage than Dr. Mayo gave to-day, 35 per cent., die from cancer of the stomach.

There are several points which, I think, ought to be made clear in connection with cancer of the stomach. It is frequently impossible to make a positive diagnosis at such time as to warrant a radical operation from symptoms alone, but nearly always there will be enough symptoms to warrant an exploratory operation. My judgment is that in a disease which is so common and so fatal, and which so quickly passes the operable stage, more frequent exploratory laparotomies are necessary and should be demanded. The symptoms of cancer

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are vague, indefinite and widely variant, depending much on its location. At the cardia they may be pronounced early; at the pylorus, the more usual site, they are usually late and due to obstruction. The surgeon should, moreover, be held accountable for the proper surgical procedure. Palliative operations are of questionable utility. Encouraging as it is to have Dr. Mayo tell us that in 38 per cent. of his operations there has been a three-years' cure and in 25 per cent. a five-years' cure, could we not do a great deal better if we operated during the precancerous stage or when the lesion is still benign, or simple ulcer? Not only do we find cancer engrafted on ulcer in more than 50 per cent. of the cases at the Rochester clinic, but Mayo Robson finds it also in 59 per cent. of his cases, Moynihan in 72 per cent. and a Russian authority, Shaperko, in 90 per cent. Many of the French surgeons assert that every case of cancer is necessarily preceded by ulcer. Why is it not better, therefore, to excise all ulcers of the stomach, or at least those which are hard and callous and situated in the pyloric region and which constitute about 80 per cent. of cancers of the stomach. We cannot escape the conclusion that there must be a close etiologic connection between benign and malignant ulceration of the stomach, and that the time to cure cancer is when it is still a simple ulcer. This can be done with a very small mortality. I believe, and have believed for many years, that we shall live to see the time when all ulcers that are not bound down by prohibitive adhesions to the pancreas, gall-bladder, the large intestine, etc., will be promptly excised. I have followed this practice for the last thirteen years.

Dr. John B. Deaver, Philadelphia: As Dr. Mayo's statistics show, cancer of the stomach is a curable disease if taken in the curable stage. Dr. Mayo has shown that there is practically no mortality (0.6 of 1 per cent.) in an exploratory operation. This is a strong argument and one that should appeal to us. To perform an exploratory operation is practically taking no risk at all and, as Dr. Mayo also said, it is the final test. I was glad to hear Dr. Mayo's statement that roentgenoscopy has been of service in aiding early diagnosis and in showing the extent of the disease in certain cases.

Dr. John A. Lyons, Chicago: I wish to add to the discussion this much: I sent a friend of mine to Rochester about two months ago for the removal of a cancer. The abdomen was opened, and it was discovered by Dr. Mayo that there was no cancer, but an ulcerated condition of the stomach. Dr. Mayo informed my friend that in six weeks he would be as well as ever. Cancer of the stomach had been the diagnosis of several surgeons in Chicago. The patient of whom I speak had lost 46 pounds and he is well to-day and has a fair prospect of living many years.

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DR. W. J. MAYO, Rochester, Minn.: I think we all occasionally make the mistake in certain cases of treating as ulcer a lesion which afterward proves to be cancer. It is difficult to determine, by the ordinary methods of diagnosis during operation, whether a certain gastric ulcer is benign or malignant. Unless we can procure a piece of tissue for diagnosis we must be guarded in our statements. The opposite mistake also occurs. In our clinic several patients on whom palliative operations were done for supposed hopeless gastric cancer remained well for more than five years. The operations were done for the relief of obstruction. We cannot, therefore, blame the medical man for not always making a diagnosis of cancer of the stomach, as he must employ indirect methods when we sometimes fail with direct ones. In the examination of these patients one should keep at least four things in mind: First, is there a tumor and is it movable? Repeated examinations should be made if in doubt; second, food remnants in the gastric content; third, Roentgen-ray bismuth photographs; fourth, examination of test-meal, etc.

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CANCER OF THE UTERUS

SOME POINTS TO BE EMPHASIZED IN THE EARLY DIAGNOSIS

RUFUS B. HALL, M.D.
CINCINNATI

It is desirable to consider the diagnosis of cancer involving the cervix, and that involving the body of the uterus, separately. Therefore, I shall take up first the early symptoms of the disease involving the cervix, and later those involving the body of the uterus.

Cancer of the uterus has received more attention from gynecologists than any other disease peculiar to women. One must be convinced by study of the literature that the large part of this energy in the past has been directed toward the perfection of operative technic rather than to the more important problem of early diagnosis. The technic of the operation by the vaginal or abdominal route, or by a combination of both, has been perfected until little more is to be desired along that line. But what has the profession accomplished in the last decade in early diagnosis of cancer, that has benefited these patients? Scarcely anything at all.

While the men engaged in this special work have made advances in the early diagnosis of the disease, it does not benefit the great majority of these unfortunate patients, because we have not taught the family physician, who sees these patients first, to make the diagnosis in time for early operation. That many patients come to operation too late to promise a reasonable hope of cure, every operator of experience must admit. If an early diagnosis is to be made, it must be through the education of the

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laity by the family physician. From past experience I am convinced that the laity will not be educated until we can in some way bring home to the family physician his great responsibility. The propaganda for education of the family physician as well as the laity, inaugurated by the American Gynecological Association at its annual meeting in 1912, and more completely elaborated at the Washington meeting in 1913, should be commended and encouraged with enthusiasm by the entire profession.

I have little new to offer, but would emphasize some of the early symptoms of the disease that are so often neglected.

The importance of careful supervision over women regarding their sexual organs during the cancer period of life, which could be arbitrarily stated from 37 to 47 years, cannot be overestimated. I do not wish to be understood as saying that we may not encounter the disease in patients much younger or much older, but such cases are not nearly so often seen. The most trivial complaint, let it be discomfort in the pelvis or back, associated with a little watery discharge or leukorrheal discharge, or pruritus, during this period, should be investigated at once. The patient should not be permitted to go four or six months, or even a year, without an examination to determine the cause of these symptoms, as most of these patients are permitted to do now, before their physician examines them. During the past five years, for every case of cancer of the cervix coming under my observation early enough for an operation that justified the removal of the uterus, sixteen others came too late. For the five years just preceding that period, the ratio was one to twenty-one. In cancer of the body of the uterus the ratio was one to four. The vast majority had consulted their physician several times, seeking advice for symptoms that were directly associated with the pelvic organs, such as pain in the back, irritable bladder, vaginal discharge or a little bleeding between the periods, and were treated expectantly without a vaginal examination being made or even suggested.

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It is true that many of these patients did not apply to their physician for a vaginal examination but consulted him for advice. It is the family physician's duty, however, to investigate every case in which the patient gives symptoms referable to the sexual organs during the cancer period of life, just as carefully as though he believed she had cancer, until he proves that she has or has not. When every physician realizes how important it is to the patient for him to do so, we have the key to the situation. We shall then have a great saving of suffering and prolongation of life for this unfortunate class of women. I am convinced that if these women were carefully examined by the family physician early, he would have little or no difficulty in convincing himself that the patient had cancer or that there was something out of the usual in her condition, and he would seek a consultation. Early diagnosis is of great importance to the family physician, in addition to the great good rendered his patient, because these patients and their friends invariably criticize his management of the case if he has delayed making an examination or has neglected to make one when they find that the disease has advanced beyond the operative stage. This criticism would be avoided if he investigated the case and made the necessary examination as it should be made at once, when the patient first applied for relief.

In the early diagnosis of cancer of the cervix, one should not overlook the fact that trauma due to childbirth plays an important rôle in the etiology of the disease. More than 98 per cent. of cases of cancer of the cervix occur in women who have borne children. Heredity does not appear to have as much bearing on the disease as it apparently does in carcinoma of the breast. Less than 10 per cent. of all cases of cancer of the cervix give a history of any member in the family having had cancer in any part of the body. A clinical record of every case examined by me is kept and filed. It is from these records, extending over a period of twenty-five years, that these deductions are made.

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The early symptoms of cancer of the cervix, which I have observed in the order of their importance, are: (1) a watery discharge; (2) an irritable bladder; (3) a little irregular bleeding, and (4) a disagreeable odor. In reference to the watery discharge, I do not mean the ordinary leukorrheal discharge that women frequently complain of, but a watery discharge not unlike beef brine in its appearance. It may not be very profuse, but enough to stain the linen brownish. It irritates the vulva. It is more or less constant for a varying period of from five or six weeks to three or four months, before the patient considers herself ill. This is a most important symptom. If the history of the patient is carefully taken at the time, most of these patients soon after the watery discharge is noticed will give a history of irritable bladder; that is, they say that they must empty the bladder more frequently than before. They are relieved after the bladder is empty and they have little or no tenesmus. Where the patient could formerly go from four to six hours without discomfort, she now has to empty the bladder every two or three hours, and when she is unable to do this she is in distress. This is a most valuable early symptom and should be carefully considered. There is also associated with the watery discharge a vulvar pruritus in a large number of cases. Pruritus not associated with glycosuria during the cancer period of life should be carefully and immediately investigated to determine the exact cause.

The irregular bleeding amounting merely to a spot on the clothing between the periods is not an early sign of the disease, but it is one that should be immediately investigated. If the history of the case were taken at the time that the first bleeding is observed, there would be no difficulty in establishing the diagnosis of cancer, and that it has existed for a period of three or four months, or even longer. In almost every case it would be found that the symptoms enumerated had been present and observed by the patient for many weeks, in some

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instances for months, before the first bleeding occurred. Bleeding is not an early symptom. Many writers insist that one of the early symptoms of cancer of the cervix is irregular bleeding. It may be an early prominent symptom in some cases, but almost all these patients have other well-marked symptoms before the first bleeding is observed. The difficulty is to get the profession to place the proper importance on the apparently trivial symptoms. The disagreeable odor so much spoken of by most writers is a late symptom of the disease. This odor is from decomposition, a breaking down of the tissues. Necrosis must occur before there is the disagreeable odor for which so many doctors wait before they venture the opinion that the case is one of cancer.

Hemorrhage and pain come late in the disease. When the patient complains of severe pain and has had several hemorrhages, it will be found that she has passed the time when an operation for extirpation of the uterus would be of much permanent benefit.

One must differentiate cancer of the cervix early in its history from (1) erosion, (2) laceration, when the cervix is inflamed, (3) cystic degeneration, (4) tuberculous ulcer and (5) chancre. The diagnosis early is much easier than is generally supposed. When cancer is suspected from the history of the case, a careful vaginal examination is made by touch. If malignant disease is present, a small nodule is to be found. It is usually in the angle of a previous laceration and it can be distinctly felt as a little lump under the examining finger, entirely different to the touch from any other portion of the cervix.

In erosion, the entire cervix in every place feels exactly the same under the examining finger. Every portion of the cervix feels alike in a lacerated, inflamed cervix. There is no hard point the size of a bean or larger, and the entire ulcerated cervix feels alike. With a speculum the cancer appears different on inspection from the other tissues around. It bleeds more easily when touched with

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a probe. In erosion the whole cervix bleeds easily on touch and there is no hard point. In laceration every portion is alike. In cystic degeneration, under the examining finger one feels hard, round, small tumors, seldom one, usually several. On viewing the parts through a speculum, one finds that the cervix has the same appearance over the entire portion. There is no redness over these little hard bodies. When one is punctured by the knife, with the discharge of mucus the diagnosis is complete. It is hardly necessary to say that the examination would not be complete in any doubtful case without a microscopic examination of a portion of the diseased tissue.

Tuberculous ulcer is so rare, as compared with cancer, that the presumption would be in favor of cancer. The one case which I observed occurred in a patient who was far advanced in general tuberculosis. In that case there was no difficulty in deciding that the case was not one of cancer of the cervix.

From chancre, which is also comparatively rare, there should not be much difficulty in making a correct diagnosis. The sensation by touch is different from every other condition. The deep-seated ulceration, the hardened edge, with sharp, well-defined border, and the signs of syphilis in other parts of the body, should make the differential diagnosis in most cases exceedingly easy.

The early diagnosis of malignant disease of the body of the uterus is also very much neglected by the profession at large. Most cases are permitted to drift under palliative measures for a year, before cancer is seriously considered by the physician. The disease is so insidious in its onset, that if the first symptoms are observed within a year or two after the cessation of menstruation, the patient naturally attributes her symptoms to the menopause, and usually delays consulting her physician until the disease is far advanced. This form of cancer may and does occur in the maiden as well as in the woman who has borne children, which is not true in cancer of the cervix.

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The disease is comparatively rare before the menopause. The majority of the patients whom I have seen were past 50 years of age. The earliest symptoms observed in these patients, by careful tabulation and review of their clinical histories, have been a watery discharge with a little bleeding (not a hemorrhage), at irregular periods, coming on several years after the establishment of the menopause. Associated with this discharge, every one of these patients complained of pruritus. Nearly every patient applied to her physician for relief from that annoying symptom, not suspecting that the discharge had any relation whatever to the pruritus. The discharge was not great enough to alarm the patient but enough to leave spots on the linen. As the disease progressed and after it had existed for from six months to a year, the bleeding, which heretofore had been just a spot on rare occasions, became more frequent and a little more in quantity, associated with a discomfort almost amounting to a pain in the back, or pain in the region of the uterus, or both. The pain comes late in the disease when the uterus is enlarged by the new growth, and the uterine muscle makes an effort to rid itself of the foreign body.

The diagnosis of malignant disease of the body of the uterus early in its history is not at all difficult, and there is no excuse whatever for this unseemly delay. With the clinical history, the physician should proceed to the examination. He will find that the uterus is enlarged, freely movable, and more sensitive than normal, with no perceptible disease of the cervix. If the disease is far advanced, the uterus may be greatly enlarged. A probe passed gently into it shows that the organ measures 3 inches or more in depth. The slightest manipulation of the probe will cause a free discharge of bright red blood. If a positive diagnosis cannot be made at this examination, it is the physician's duty to give the patient an anesthetic and explore the uterus thoroughly. He should curet it thoroughly and have a careful microscopic

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examination made of the scrapings. If this procedure is done, a diagnosis in a majority of cases would be made at the first curetting. If, however, a positive diagnosis of cancer cannot be made and the patient continues to bleed, in the course of six or eight weeks she should again be anesthetized and the uterus thoroughly explored and curetted, and a microscopic examination of the specimen made. Only on a few occasions have I been compelled to do a second curetting to confirm or disprove the diagnosis of cancer, when the clinical history and the symptoms justified that suspicion.

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THEORETICAL AND PRACTICAL FOUNDATIONS OF A RADICAL OPERATION FOR CARCINOMA OF THE CERVIX UTERI

EMIL RIES, M.D.
CHICAGO

The cause of carcinoma is at present unknown. Our knowledge of carcinoma in the human being is built up on clinical and pathologic observations. These have led to certain conclusions as to the growth of carcinoma, which may be summed up approximately as follows:

Carcinoma in its beginning is a purely local disease of a circumscribed group of epithelial cells. The tumor invades the host in two ways: first, by contiguity, and second, by the establishment of colonies or metastases, which are endowed with the same activities as the primary tumor.

The contiguous growth invades lymph-channels early and regularly, the blood circulation rather incidentally, irregularly and, we may say, less frequently. The primary tumor is subject to changes in two ways: first, degeneration, and second, infection. The metastases established especially along the lymphatic system are subject to the same changes, necrosis taking place in them and infection reaching them through the same or similar channels through which originally the carcinoma has reached them.

In the beginning, when there is no carcinoma in the patient's body except the original focus, a piece of tissue which comprises all of this tumor is a simple block of tissue by the removal of which, theroretically at least, the entire carcinoma can be eliminated. As soon as colonies

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have become established, a block of tissue which is to include the entire carcinoma must include besides the original tumor all the metastases or colonies. In order to excise such a block, we ought to have full and complete knowledge of all the metastases present in a given case. With our present methods this knowledge is absolutely unattainable. Therefore the outlines of the block of tissue which we have removed in carcinoma operations, and which we have hoped or intended to represent all the carcinomatous tissue, has been dictated by guesses as to the extent of carcinoma in the individual case rather than by exact knowledge.

This block of tissue, which we may call the "carcinomatous block," is limited in one stage of our surgery of carcinoma of the cervix by the cervix itself, in a later stage by the outlines of the uterus and for the most advanced surgeon by considerably wider boundaries. We have enlarged the carcinomatous block in all carcinoma operations. The enlargement of the carcinomatous block in carcinoma of the cervix has been justified no less by the investigation of the specimens removed by the operation than by the improved remote results. It therefore has now a pathologic and statistical basis which was entirely lacking in 1895 when I first proposed this operation. But even to-day the delimitation of the large block is an arbitrary matter, and it is one of the fundamental weaknesses of all of our carcinoma operations that it must remain arbitrary so long as we have no means of preoperative diagnosis of the number and extent of the metastases, and therefore of the proper size of the carcinomatous block.

We consider the metastases of carcinoma to be derivatives of the original carcinoma, cellular constituents of which we believe to have been carried through the lymphatic channels to the lymphatic lymph-nodes. We also have concluded that it is necessary to include in the carcinomatous block all the lymph-vessels between the original focus and the metastatic focus in the

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lymph-node. We have been forced to this conclusion by the uncertainty as to what might happen if we cut across a lymph-vessel between the primary and the secondary focus. Two risks inherent to such operating have to be considered: first, the risk of leaving behind carcinoma metastases in a lymph-vessel which would lead to false recurrences, and, secondly, the risk of cutting through a lymph-vessel at a point where carcinoma is in its lumen and thereby spreading carcinoma in the wound, producing implantation recurrence. On the other hand, we must not forget that these theoretical considerations are not any too well founded on actual observations. It is no exaggeration to say that hundreds of thousands of sections have been examined since 1895 by others as well as by myself. But in spite of this immense amount of material it has hardly ever been possible actually to demonstrate carcinoma in transit from the original to the secondary focus. Carcinoma in lymph channels in the immediate neighborhood of the primary focus, or in the capsule or near the capsule of lymph-nodes, has been demonstrated often by myself and others. But observations of carcinoma in transit at a distance from both the primary focus and the regionary lymph-nodes, say halfway between them in the broad ligament, are so rare as to be practically unknown. This is a point which deserves more consideration than has been accorded it so far. I am well aware, however, of the fact that it is practically impossible to recognize one or two isolated cancer cells in a lymph-vessel, and that therein may lie the reason why there are no extensive observations of carcinoma in transit.

In spite of this lack of actual observations of carcinoma in transit, it is absolutely logical to include in the carcinoma block not only the primary focus and the preferential seats of the metastases, but all of the intervening tissue as well; in other words, a prerequisite of a thorough carcinoma operation is that of continuous instead of non-continuous dissection.

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The improvement in the results of operations for carcinoma in any part of the body can easily be shown to depend largely on this method of continuous, rather than discontinuous, dissection. Take, for instance, carcinoma of the breast and compare with it carcinoma of the vulva. The dissection of the carcinoma block in carcinoma of the breast is the best example of continuous dissection and the results are very fair. The operation for carcinoma of the vulva to this day is a shocking example of discontinuous dissection and its results are correspondingly miserable. In carcinoma of the breast every surgeon emphasizes the necessity of removing all of the tissue in one block. In carcinoma of the vulva the vulvar tumor is removed in one block, and, if the operator tries to be at all radical, the lymph-nodes are removed in one or two more blocks, so that altogether we get two or three blocks with intervening tissue left standing. It is not rational and the results are poor. As other examples of discontinuous dissection and poor results I may add the operations for carcinoma of the face, of the tongue, of the penis, of carcinoma of the extremities, especially Roentgen-ray carcinomas of the hands, carcinomas of the stomach, carcinoma of the gall-bladder. In all these, the operations performed usually are discontinuous dissections and in all the results are highly unsatisfactory. Improvement in results depends, therefore, not only on enlargement of the carcinomatous block, but fully as much on the method of continuous dissection.

It is evident that there are good reasons why the enlargement of the carcinomatous block and the continuous dissection are not available in all carcinomas. For instance, in carcinoma of the breast the carcinoma block, as bounded to-day and large as it is, is too small for many cases. Suffice it to mention merely the invasion of the chest wall, pleura, mediastinal lymph-nodes. On the other hand, the reasons for the discontinuous dissection of the primary tumor and the lymph-nodes in carcinoma

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of the face are also perfectly evident. Let us suppose a case of carcinoma of the cheek. To make a continuous dissection, it would be necessary to remove the whole thickness of the cheek and the jaw and all the soft parts around the tumor in order to obtain one continuous block of tissue, including the primary tumor and the lymph-nodes of the parotid, under the jaw, in the neck, etc. Aside from the risks of such an interference, it is abhorrent to our feelings to propose such mutilation, the result of which would be almost worse than death.

In comparison with such an operation on the face the operation for carcinoma of the breast is far less mutilating even though the bulk of the tissue removed exceeds many times that removed by continuous dissection of a large carcinomatous block of the face. Also the risks attached are quite different. The operation for carcinoma of the breast as carried out to-day has very slight inherent risk. The removal of the soft parts is practically free from risk and the success of such operations is limited only by the accessory risks produced by the anesthetic, infection, air aspiration, etc. The moment we decide to increase the chances of radical cure by enlargement of the carcinomatous block, and remove, for instance, the whole thickness of the chest wall (as we often do in operations for recurrent carcinoma of the breast), the inherent risks become enormously greater, as well as the accessory risks. Collapse of the lung, displacement of the heart, difficult technic of closure of the wound have then become inherent risks of the operation. Longer anesthesia and restricted function of the lungs are some of the increased accessory risks. The fact that continuous dissection is carried out might improve the remote results, but the gain might easily be offset, in part or entirely, by the increased inherent and accessory risks.

The accessory risks from anesthetic or infection carried in from the outside are the same in carcinoma of the cervix as in other carcinoma operations. But the gravest

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accessory risk in carcinoma of the cervix is that of sepsis from the infected primary tumor. I am not speaking of the infection which might be carried into the peritoneum by dragging the infected cervix through the abdominal cavity. Proper technic has reduced this risk to a minimum. But there are two other ways in which infection can gain access to the peritoneum and the pelvic connective tissue in the course of the operation. One is the much-dreaded tearing of the cervix, complete or incomplete, and the other is the infection of the field from crumbling lymph-nodes, which in addition to the carcinoma have been loaded with virulent germs from the primary focus. There is very little doubt in my mind (though I have not been able to confirm this suspicion by actual microscopic observations) that virulent germs may lurk not only in suppurating lymph-nodes, but in lymph-vessels in their neighborhood as well. Even if it is possible to clean up a primary carcinoma of the cervix fairly thoroughly before the operation, I cannot see how this danger of infection from infected lymph-nodes or lymph-vessels can be deviated.

In carcinoma of the cervix the enlargement of the block to the limits which I indicated in 1895 has improved the remote results wonderfully. But the improvement was at the cost of increased inherent risks from hemorrhage, injury to ureters and establishment of large wounds in the connective tissue. At the same time it has not been possible to make the dissection in carcinoma of the cervix a truly continuous one. Though we attempt to remove the lymph-nodes and the pelvic connective tissue in one block with ligaments, uterus, tubes, ovaries and vagina, the small amount of tissue which surrounds the glands often renders this attempt abortive. In addition thereto, the dissection of the ureters out of the broad ligaments unavoidably makes a breach in the principle of continuous dissection. And this constitutes another weakness of the operation for carcinoma of the cervix.

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This weak point could be eliminated if we could make up our minds to force the continuous dissection by including the ureters in the carcinomatous block and resecting them every time. The reason that we do not do so lies in the simple fact that there is a limit of tolerance, I am tempted to say, of the operator as well as of the patient. The operation for carcinoma of the cervix, as it should be carried out, is the most extensive operation I know of in surgery. I am sure that the carcinomatous block in this operation, as I carry it out, is as large as anybody has ever made it, but it is not so large as I should like to make it. In fact, I am considering its enlargement at least in the direction of the pelvic diaphragm and the paracolpium. This may mean greater demands on the tolerance of the patient, and it would be highly desirable to have some means of determining beforehand the limits of this tolerance in individual cases. But so far we have no reliable means of determination, not even in a negative way. It is surprising how sometimes emaciated, anemic, cachectic women stand the most extensive operations, while others who seem in comparative good health will succumb. Neither blood-counts nor urinary examinations, neither examination of the circulatory system nor any other methods that I know of, are reliable.

To-day the surgeon who operates for carcinoma of the cervix in the modern way is well aware of the fact that the size of the carcinomatous block and the method of continuous dissection on one side tend to improve his remote results to a degree never before attained, but he is also aware that the inherent and accessory risks of such operations in the absence of reliable methods of preliminary determination of the limit of endurance are bound to increase his operative mortality. Operative mortality and remote results therefore have the tendency to show an inverted ratio.

The better the surgeon's technic the greater things he may dare. The world, and even parts of the medical

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world, not to mention the patients and their families, are utterly unaware of the difficulties encompassing such work. It requires sometimes a strong sense of surgical duty to persist in this most difficult and risky field. No man with any conscience will undertake such operations without extensive experience in abdominal surgery. But the prize is worth striving for. To this moment there is only one cure for carcinoma of the cervix—the operation; and my patients operated on from five to fifteen years ago and well to-day are the best witnesses to this fact. The statistics of all modern operators show a rich harvest of patients surviving for similar periods. Let me repeat: there is no other treatment of carcinoma that can show such results. Therefore it is to-day wrong and unscientific to withhold the chance of operation from any patient with carcinoma of the cervix or to waste valuable time with any treatment except operation, and this in spite of all risks which the operation involves.

32 North State Street.

ABSTRACT OF DISCUSSION

ON PAPERS OF DRS. HALL AND RIES

DR. J. H. CARSTENS, Detroit: One woman out of eight dies of cancer to-day. Think of that! Dr. Hall's paper is opportune and essential. I have been trying to do something in that direction. We must talk cancer day in and day out. You cannot impress the people, you cannot impress the profession unless you talk and talk and talk and show them the fearful results. They are careless, they do not think about it. I have been advocating for several years that we set aside one day in the year as cancer day; that all the newspapers write about cancer, that all the ministers preach about cancer and that all the lay press write and print "Cancer, cancer, cancer," so that the people will be aroused and the profession will be aroused and these cases will have early attention. Cancer starts locally microscopic and then is the size of a mustard seed. Found early it can be removed and that is the end of it; but you must look for it. The medical profession neglects these cases. In Michigan I tried for a number of years to get the state board of health to issue a cancer circular. This was finally done and a circular on the symptoms and how to cure cancer was sent to all the physicians and distributed among the people. Now they have started this work at the meeting in Washington. I went to the lay

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editors and told them about the fearful mortality from cancer and asked them to write and publish the matter and had them interview a dozen doctors, and they have written a number of articles and have stirred up the people about the cancer question so that they will be a little more vigilant. The point I have made is that if a woman has a slight discharge there is something wrong with her pelvic organs and she ought to give them attention. Some doctors are careless. I tell these women that if their doctor says, "Madam, I am going to examine you," and dissects away a little piece of tissue for examination he is a good doctor. That is the doctrine we must preach in season and out of season.

Dr. Walter B. Dorsett, St. Louis: I wish to say a word on the importance of making an early diagnosis of cancer of the body of the uterus. Dr. Hall spoke of the use of the curet by the family physician for the purpose of getting scrapings to make an examination. This I do not approve of at all. I believe that a physician should be ready to operate when he has done his curettement, not stir up matters to-day and operate next week. I am impressed with the importance of this matter from the knowledge of three cases. In one a physician attempted to curet with a sharp curet for the purpose of making diagnosis, and he punctured the uterus. The patient died. In another case I myself punctured the uterus with a curet, thinking that possibly I had a retained placenta to deal with. I immediately opened the abdomen, removed the uterus and saved the patient. Other cases of this kind have been mentioned. I believe that the curet is an instrument which can be used for diagnostic purposes under proper conditions, but whenever it is used the physician should be ready to do a major operation as soon as he has finished the curettement, if any accident should occur. Even if nothing has occurred, the operation should be done in a short time afterward.

Dr. G. Betton Massey, Philadelphia: I wish to emphasize the importance of what was said by Dr. Dorsett about the danger involved in making a diagnosis by the curet. That practice will probably be continued until surgeons act fairly on their own convictions of the parasitic nature of cancer. As was stated the other day by Willy Meyer in a cancer discussion in New York, pathologists still deny the parasitic nature of cancer, but surgeons regard the disease as parasitic. I wish to emphasize strongly my own conviction that if they believe in the parasitic nature of cancer they are acting wrongly to curet these growths. No cancer should be wounded until preparations are made for immediate destruction or removal. I submit that until the parasitic nature of cancer is disproved, the history of cancer operations reflected here, particularly in the pelvis, compels us to assume that it is parasitic, and to adopt such precautions in operation that

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these parasites shall not be transferred living to the cut edges of the wound.

DR. WILLIAM J. MAYO, Rochester, Minn.: I was particularly interested in what Dr. Ries said in regard to the foundation for an operation for cancer and the reason for doing a block dissection. I agree with him that up to the present time the experimental work on cancer in animals and plants has not been of great value as an aid to clinical diagnosis or to treatment, but I do believe that this work will finally lead to the solution of the cancer problem. We cannot experiment on the living human being. If those of you who are interested will go to the other side of this floor, you will see an exhibition of plant cancer, which to my mind is the greatest piece of research work on cancer which has ever been demonstrated. This work has been done by Dr. Edwin Smith of the Department of Agriculture, Washington. Dr. Smith has been able to produce, by a species of bacteria, cancer in plants which agrees in many essentials with what we know of cancer in the human being and of cancer in the animal which has been produced experimentally. These bacteria produce cancer, but only when there is traumatism or irritation at the point of introduction. He has shown that these bacteria stimulate growth in the plant; they respond by throwing out an unlimited number of embryonic cells, that is, a true cancer. In plant cancer the bacteria die and the endotoxins in their bodies stimulate the plant cell-nuclei, which take on a fresh growth, and this process goes on indefinitely. Dr. Smith's splendid work, taken in connection with Auer's work on cancer in chicken, gives an interesting picture. In his experimental work, Auer tried to produce the disease as we see it in the human being, but he could only cause tumor at the point of injection. He then added to the injection the skeleton of diatoms, which produced mechanical irritation of the tissues. He was then able to demonstrate multiple cancer lesions. No case of cancer of the skin has been reported that did not develop on a previous lesion. It must be the same in the internal surfaces of the body. It is to be found in the mouths of persons, both male and female, who chew the betel nut, and on the lip of the pipe smoker. It is prevalent in natives of Kurdistan on the skin of the abdomen, the result of heat irritation from the charcoal warmer they use. We have further examples in ulcer and cancer of the stomach, gall-stones and cancer of the gall-bladder, myomas of the uterus and cancer of the corpus uteri. It is said that the savage people do not suffer from cancer, which is probably not true, since their economic necessities make cancer the means of speedy death.

DR. JOHN B. DEAVER, Philadelphia: I believe that in a certain proportion of cases of cancer of the fundus the pathologist in examining the scrapings, like the surgeon, makes

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mistakes in his interpretation. In those cases of uterine bleeding in which adnexal disease and gross disease of the uterus can be excluded, but in which there is question of doubt, I make a hysterotomy, and in this wise am sure of the condition of the interior of the uterus.

DR. C. O. THIENHAUS, Milwaukee, Wis.: It cannot be too strongly emphasized that a microscopic examination is the authentic proof of malignancy or non-malignancy. When the general practitioner sends a specimen of diseased tissue to the pathologic anatomist for microscopic examination he should know how to excise that specimen. He should not merely snip off a little piece of tissue, but should also see to it that the specimen for examination contains that part of the tumor or ulcer in which the normal tissue transgresses into the diseased tissue.

In regard to removal of glands in cases of cancer I should like to say this: Nobody removes a cancer of the breast without cleaning out the lymph-nodes in the axilla. Nobody removes a cancer of the tongue without paying careful attention to the removal of the lymph-nodes in question; nobody operates for cancer of the anus or clitoris without cleaning out the inguinal region. In the same manner in cases of cancer of the uterus the glands in the abdomen must be removed, and the removal of those glands has given the Ries-Wertheim operation the high standing and preference above all other operations for cancer of the uterus. Of course, often lymph-nodes may be swollen and still not be infected by cancer. This we find in cases of cancer of the stomach. I observed a case similar to that mentioned by Dr. Mayo this afternoon. After opening the abdomen I found a large immovable mass in the posterior wall of the stomach together with swollen lymph-nodes. I performed an anterior gastro-enterostomy, believing that the patient would die within two years. After three years, however, he walked into my office looking well and feeling well. Our diagnosis of cancer of the stomach was wrong. We had to deal with an ulcer.

DR. JOHN A. LYONS, Chicago: The cautery knife should be the instrument of choice in these desperate cases, in order to block the lymph-channels, prevent dangerous hemorrhage by plugging the blood-vessels and severe pain by sealing the cut nerve-supply. In these cases the knife, scissors and especially the curet should not be used.

DR. BERTHA VAN HOOSEN, Chicago: From the papers we have just heard we should be led to believe that the symptom of the first stage of cancer is a profuse discharge. I believe that the symptoms of the first stage of cancer are *nil*, and for that reason we shall have to do a great deal of educating of the public before we shall ever get cancer in its first stage. Not long ago a patient came to me with dysmenorrhea. I curetted as a matter of routine and sent the specimen to the

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laboratory. To my surprise the report was cancer of the body of the uterus. I thought that it must be a mistake, but proof was given from the examination of the specimen after removal. Shortly before that in another case I had removed a small piece from the cervix which was suspicious, but found no cancerous tissue. I proceeded on that diagnosis to amputate the cervix and do other plastic operations for prolapse. The removed cervix was sent to the laboratory and, in parts not suspicious, cancer was found. We are also taught a great deal about the age from 37 to 47. I saw within the last two years an inoperable carcinoma of the cervix involving the whole of the body of the uterus and all the lymph-nodes, and sections showed a far-advanced cancer of the cervix, in a patient not yet 20 years of age. I think, in view of some of these conditions, that it behooves the profession not to appeal so much to the laity, but to practice more routine examinations on all tissues removed from the pelvis, to discredit age and hemorrhage and to look for carcinoma everywhere and anywhere.

Three weeks ago I operated on a patient who had a small lump in the breast. It proved to be a medullary cancer. She also had a slightly enlarged prolapsed ovary. In this prolapsed ovary was medullary carcinoma. Panhysterectomy was done and the radical operation for the breast. Just exactly where the blocking of Dr. Ries comes in in this case I should like to have explained.

DR. HENRY O. MARCY, Boston: The cautery is used with much more safety if asbestos is employed to prevent the heat from being absorbed. I am reminded by the discussion that some years ago in my bacteriologic research work I developed an organism that without question originated in cancer. It "bred true" through several reproductions. Unfortunately, however, I failed utterly in securing its reproduction in the lower animals.

DR. R. B. HALL, Cincinnati: I grant that Dr. Dorsett is correct in his statements that in these cases patients should not be curetted promiscuously. In my paper I did not speak of the curet in any sense in connection with the diagnosis of cancer late in the disease; I was talking about the early symptoms in these cases. This paper is made up of records of every patient I have had in my office in twenty-five years. These tabulated reports are absolutely correct. The symptoms mentioned in the paper do occur in the early history of cancer just as tabulated, and, if we get the profession at large to consider them, we shall make diagnosis of cancer of the uterus much earlier than heretofore. It is the general practitioner who first sees these cases, and he has the destiny of the people in his hands. I do not curet for diagnosis of cancer of the cervix. It is not necessary, as a rule. Cancer of the body of the uterus is a different proposition. In many cases it is not possible to make a diagnosis early in the disease without

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curetting. In the case in which there was perforation in the body of the uterus, disease had existed for a long time. There was a large cancer mass when the uterus was curetted. There was no normal uterine tissue left. That was not an early case; it was later in the disease. If one did occasionally perforate the uterus in his effort at a correct diagnosis, would it not be vastly better than to have this great number come too late for operation because no attempt had been made to make a correct diagnosis early enough to render the proper treatment? I think that it would.

DR. J. F. PERCY, Galesburg, Ill.: To me the most important sign is inability to move the mucous membrane over the cervix. I have never seen it mentioned in text-books. I do not believe that it is original with me, but it is a most valuable point. If one cannot move the mucous membrane over the underlying structures, malignancy is almost certainly present. Within two years a woman came to me with procidentia, a complete dropping of the uterus out of the vagina. On the cervix there was a small carcinoma. I cauterized that cervix merely by sticking one of my small cautery irons into the cervical canal. Then I fastened the vaginal walls to the broad ligaments, and removed the uterus. I felt comfortable, believing that I had done the right thing. Within six weeks that woman's pelvis was full of cancer, and within three months she died. I am getting cases after hysterectomy. Within five months I had a case in which the pubic region stood four inches above the level of the abdomen. The woman was cachectic and in a condition you can readily imagine. I stuck the cautery iron up through the vault of the vagina and allowed it to cook there for forty-five minutes. My assistant tried with his fingers to get around the mass in the pelvis. There were metastases in the liver and everywhere else. The woman recently died, but she died comfortably because I had inhibited the rapid progress of the disease. I saw a woman recently who was only 28 years of age to whom three different physicians had been giving local treatment for a year and a half. The only reason for discontinuing these treatments was that they caused so much hemorrhage that she became frightened. You can do nothing with the knife for a growth like that.

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REPORT OF THE COMMITTEE ON THE TREATMENT OF PUERPERAL FEVER

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At the last meeting of the American Medical Association held at Atlantic City, Dr. T. J. Watkins read a paper on the treatment of puerperal infection, advocating a non-interfering, expectant policy. In the discussion that followed, two widely divergent opinions were voiced. Some would immediately attack the uterus and empty it of its contents; others would wait for Nature to expel ovular remnants.

In proposing that a committee be appointed to investigate the subject, three purposes were kept in mind: (1) to obtain the opinions of authorities and of the profession at large, thus to learn what is the general teaching and practice of to-day; (2) to call general attention to the importance of the subject; (3) if possible, to formulate a course of procedure which would be generally applicable to the treatment of sepsis with retained ovular material.

It was decided to send a letter of inquiry to the profession. The questions reproduced herewith were sent out as follows: 400 letters to professors and assistant professors of obstetrics and gynecology in the United States and Canada; 200 to professors and assistant pro-

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fessors of surgery in the United States; 60 to professors of obstetrics and gynecology abroad—to England, Ireland, Scotland, Germany, France, the Netherlands, Russia and Italy. In addition, the first three questions were published in THE JOURNAL.

In all, 302 replies were received, of which 197 came from obstetricians and gynecologists, 53 from surgeons, 38 from foreign gynecologists and 14 from general practitioners who saw the questions in THE JOURNAL.

Following is a detailed classification of the replies. In advance it must be stated that although the questions were prepared with great care and made as direct as possible, so as to elicit an opinion that could be readily classified, still a certain amount of freedom was expected in answering, and we did not anticipate dogmatic unqualified statements. The results, on the whole, were good, since it was possible in nearly all instances to judge from the general tone of the answers what was the individual practice of the writer.

Question 1.—"A primipara with septic abortion at three months, fever two days, hemorrhage negligible, the ovum intact, retained. What would you do?"

This question was intended to cover that large class of cases in which the criminal abortionist has attempted to induce abortion in one way or the other and has succeeded only in infecting the uterus and its contents. by twelve of the writers this question was misunderstood, they holding that the ovum had been expelled intact. In later blanks issued, the word "retained" was added. It is probable that the words *in situ* would have been better, although only 4 per cent. did not grasp the exact meaning. We divided the replies into three groups: First, those who would clean out the uterus; second, those who would treat the uterus expectantly, only interfering when hemorrhage or other condition demanded; and third, those who would use mild disinfectant and expectant treatment, such as uterine douches and gauze packing.

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TABLE 1—ANSWERS TO QUESTION 1

	Clean Out	Expectant	Mild Disinfectant and Expectant
189 Obstetricians and gynecologists ..	139	32	18
51 Surgeons	42	4	5
37 European authorities	32	0	5
14 General practitioners	11	0	3

Question 2.—"A primipara with septic abortion at three months, fever two days, hemorrhage negligible, the fetus expelled, placenta retained. What would you do?"

The same division of the replies was made.

TABLE 2.—ANSWERS TO QUESTION 2

	Clean Out	Expectant	Mild Disinfectant and Expectant
197 Obstetricians and gynecologists..	156	33	8
49 Surgeons	41	3	5
38 European authorities	33	2	3
13 General practitioners	10	0	3

Question 3.—"A primipara, fourth day after full-term delivery, positive evidence of uterine infection, no hemorrhage, retention of ovular remnants suspected. What would you do?"

This question was very carefully drawn, because it was the object of the committee to discover on how much, or how little, provocation the uterus was invaded after labor at term. Furthermore, in actual practice, it is very difficult to be certain that there are ovular remnants in the uterus.

TABLE 3.—ANSWERS TO QUESTION 3

	Clean Out	Expectant	Mild Disinfectant and Expectant
183 Obstetricians and gynecologists ..	136	34	13
52 Surgeons	36	4	12
38 European authorities	27	4	7
13 General practitioners	8	0	5

It will be noted that in general the treatment advocated for these three conditions is about the same by the individual operator; i. e., it is clean out or not in all three cases. The totals do not always tally because some men did not answer all the questions.

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Question 4.—"If you (a) believe in active interference, (b) when do you do it?"

The committee wished further to know how urgent interference in septic cases was considered, and therefore propounded Question 4.

TABLE 4.—ANSWERS TO QUESTION 4

(A) ACTIVE INTERFERENCE

	At Once	Within 24 Hours	Later
154 Obstetricians and gynecologists..	128	8	18
41 Surgeons	32	0	9
33 European authorities	24	7	0
9 General practitioners	6	0	3

(B) TIME OF INTERFERENCE

	Obstetricians and Gynecologists.	Surgeons	European Authorities	General Practitioners
Curet—dull	70	21	9	6
Curet—sharp	19	5	0	0
Curet—not named	24	7	10	0
Finger	127	33	34	0
Placenta forceps	96	22	14	0
Tampon	39	18	11	0

Very few operators specified one or the other method as an exclusive one. Nearly all would use the finger as a method of preference, the others as aids, or where it was impossible to insert the finger. A few specified that the finger was more dangerous than the curet.

Question 5.—"What do you do when hemorrhage complicates sepsis?"

The idea of this question was to learn how many men became more active in the treatment when hemorrhage was added to the indications for interference.

TABLE 5.—ANSWERS TO QUESTION 5

	Tampon	Douche	Curet	Finger	Medicines
Obstetricians and gynecologists	92	20	72	42	31
Surgeons	29	6	16	16	5
European authorities .	15	4	7	8	3

From this maze of answers it was possible to elicit these facts: The majority of operators do not fear to pack a septic uterus. The majority believe in emptying the uterus fully to stop hemorrhage. Few use medicines as adjuvants and still fewer use them alone.

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Question 6.—"If you believe in trusting to Nature when ovular remnants are retained, how long do you wait before operating?"

Those practitioners who trust Nature to throw off the retained material usually believe that it is more dangerous to interfere than to wait, and that active treatment of the uterus spreads the infection by breaking down Nature's barriers. We already learned what is done when hemorrhage complicates sepsis (Question 5)—we wished further to learn how long it was considered wise or safe to wait on Nature—how long a time was considered sufficient for Nature to put up an efficient barrier against the invading finger or curet. Unfortunately, these points could not be elicited from the answers.

TABLE 6.—ANSWERS TO QUESTION 6

	Wait 24 Hours	Wait 24 to 48 Hours	Wait Longer than 48 Hours
32 Obstetricians and gynecologists...	4	7	21
4 Surgeons	0	1	3
2 European authorities	0	1	1

It seems, of those who were willing to wait, the majority felt safe in waiting two days or longer. One author stated that he waits two or three weeks.

Question 7.—"Do you try to distinguish between sapremic and bacteriemic states before operating? How do you do it?"

Not long since it was believed that if a hemolytic streptococcus were found in the uterus, local interference was very dangerous, since it would almost surely be followed by a bacteriemia, but that if only saprophytic organisms were found in the uterus local interference was safe. We wished to learn how many still believed it is possible to discover whether the germs in the uterus possessed invasive qualities or not, or that they were able in any way to differentiate a purely local infection with absorption of toxins (generally known as sapremia) from a general infection (generally known as bacteriemia).

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TABLE 7.—ANSWERS TO QUESTION 7

	Try to Distinguish	Do Not Try to Distinguish	Depend on Uterine Cultures	Depend on Vaginal Cultures	Depend on Blood Cultures	Depend on Clinical Symptoms	Depend on Exploration
Obstetricians and gynecologists	80	79	40	21	28	42	3
Surgeons	16	27	11	0	4	11	0
European authorities	12	22	7	1	4	9	0

Only half of the writers believe a distinction practical. It must be admitted that European accoucheurs, in general, have better facilities for such differentiation than we do, yet with them twenty-two of thirty-four believe it is impractical.

Question 8.—"Do you make any distinction between the treatment of sepsis after abortion and that after full-term delivery?"

We might have gathered this information from a careful study of the answers to Questions 1, 2 and 3, but it was thought best to get the direct replies.

TABLE 8.—ANSWERS TO QUESTION 8

	Make Distinction	Do Not Make Any	More Active in Abortion	Less Active
Obstetricians and gynecologists	57	90	53	4
Surgeons	14	23	14	1
European authorities	9	22	9	0

The replies of those who made distinctions in the treatment of the two instances of sepsis are significant, the vast majority, fifty-three of fifty-seven, are for more active treatment in abortions. Some writers specified criminal abortion as an indication for immediate emptying and exploration of the uterus. Many would use the finger for full-term uteri, the curet for early abortions. Some would pack or douche the full-term uterus and use the curet in early pregnancy. One man wrote that he never invaded the uterus in sepsis after full term, but that he regretted it.

In the general remarks, twenty authors specifically stated that their practice is more expectant than formerly; one that he is more active locally than he used

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to be. Four state that active treatment sometimes kills the patient and two are frankly undecided as to the best course to pursue, and one acknowledges that he feels helpless in these cases. Twenty-four writers are inconsistent in their general remarks as compared with their replies to the questions, which may have been due to possible ambiguity of the latter. One writer believed that cultures from the urine would enable a diagnosis to be made of the nature of the infection.

It was not expected by the committee that definite and dogmatic answers would be returned to each question, but in this we were agreeably disappointed. It was possible in nearly all cases to determine the actual practice of the writer as to the matter at issue. What was impossible, however, was the proper evaluation of the opinions expressed. As may be seen, the replies came from obstetricians and gynecologists and surgeons holding teaching and hospital positions, from European authorities, and a very few from general practitioners. It may safely be said that the opinions are the best obtainable, yet opinions are of two kinds, resembling in this respect coins and bills. Coins have an intrinsic and a face value, bills only a face value, so also are opinions; and the ones we received are not exceptional, but it would have been a work of supererogation for us to try to separate and classify them. Two writers frankly told us that the opinions of the majority were of no value, but that light must come from the men at the top. In forming our conclusions, due weight was given to this point.

CONCLUSIONS

The majority of accoucheurs and surgeons clean out the septic uterus at once, but a not negligible minority believe that it is safe to trust the expulsion of the infected uterine contents to the powers of Nature, some assisting the same by mild measures such as antiseptic douches and packing. From this it is fair to infer that, in the majority of cases, it has been found safe to

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invade the infected uterus with finger and curet, and this is borne out by experience. There are, however, many cases in which the infection is of such a nature, or the resistance of the patient of so poor a quality, that the sudden introduction into the system of so large an amount of bacteria and toxins, as is always made by curettage, turns the scale against the patient. She cannot stand the inoculation with autogenous vaccines. The experience of the minority has proved that ovular remnants, even though infected in the uterus, do not create such dangerous conditions as we formerly believed, demanding instant removal, but that it is safe to wait for Nature to erect her own barriers against the progress of the infection, and that temporizing measures, or mildly stimulating ones, often suffice for cure. We all feel the need of some method by which it would be possible to distinguish benign from virulent bacteria living in the genitalia, but as yet no such method exists. When it does become possible, our practice will become more definite. At present one-half of the authorities do not try to make the distinction, holding it impractical. One point that was almost invariably emphasized was that after the uterus was once emptied it should not again be invaded by either finger or curet. Few would permit antiseptic douches. This is a very grateful change from the time when repeated curettages were performed on the puerperal uterus—a procedure which was as rational as curetting the throat in diphtheria. Another interesting fact that was developed is that quite generally the tampon is used to stop the bleeding in infected cases. Evidently there is not much fear of damming back the infection and permitting greater absorption.

ABSTRACT OF DISCUSSION

DR. E. E. MONTGOMERY, Philadelphia: The profession is indebted to Dr. DeLee for calling attention to the importance of this subject, on which there is the greatest variety of opinions. I must confess that, since my attention was called to it, I have varied somewhat from the statement I made

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of my own conduct in the treatment of these conditions. It had been my custom in these cases, when I could recognize material undergoing decomposition within the uterus, to remove it. I prefer the gauze-wrapped finger to the curet, as the decomposing material can be as thoroughly removed and with less danger. The cavity is painted with the tincture of iodin and packed with iodoform gauze. The gauze affords advantage in separating the surfaces, favoring the formation of establishing a wall which closes the vessels and thus permits us to remove the putrid material. If the uterus is infected and the ovum still intact I have felt it wise to evacuate the uterine contents. I have had cases in my service at the Jefferson Hospital in which we have waited, and in one of them, when the abdomen was opened later, the entire uterus was covered with an exudate and the pelvis filled with dirty material which necessitated, in our judgment, removal of the uterus in order to give the patient a chance for recovery.

My experience with patients in the hospital—and we see many who have been treated by midwives and subsequently seen by our men of experience—is that it is almost an invariable rule to curet them, sometimes even a second time. This is because they are of a class which, if not relieved by immediate operation, are rushed off to another man, who feels that he must appear to be doing something and again curets. Invariably, I try to bring these patients into the hospital because there they are under control. Although a number have come in with a temperature of from 104 to 106 degrees it has been my rule not to subject them to any further operative treatment. I remember a recent case in which the patient entered with a temperature of 106 after a second curetting. I made no attempt to investigate the uterine cavity. By keeping the patient quiet and under palliative treatment the temperature was normal within a few days and she was able, at the end of ten days, to leave the hospital.

In my experience, although the patient may be suffering from active septic infection, it is unusual to find the streptococcus in the blood. Most frequently we find the blood-culture negative. This is particularly true when the infection involves the vessels, causing thrombus and phlebitis. While it is evident that the patient is suffering from infection the blood-culture is negative. This has been shown by some writers to be due to the fact that streptococcus lodges on the sides of the vein and is not carried into the blood-current.

Dr. J. C. Litzenberg, Minneapolis: I have as a guest at my home a country practitioner, and to that class of physician I give great honor. He said to me last night, "Why did Dr. Murphy emphasize so much his condemnation of the curet? Does anyone use the curet now?" That is pretty good, coming from the country practitioner. Speaking not of the puerperal uterus, full term, but of abortions, I think that every

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incomplete abortion should be completed by the obstetrician at once, but I am greatly impressed with the ideas of those who advocate the extreme conservative position. I make a distinction between the uterus at full term and the uterus in abortion. It has been my practice always to empty the uterus in abortion, but not immediately in septic abortion. I use gauze and wait. If the uterus is dilated enough so that the placental forceps can grasp any portion of the retained ovum I use the forceps, but not the finger or the curet. If there is no hemorrhage I do not pack; if there is, I do.

I am becoming more and more conservative in the treatment of these cases and I find that the more chance Nature has the more she will do for us.

DR. ROBERT T. FRANK, New York: The country practitioner may not use the curet, but I am quite sure, from what I have seen in New York, that the city practitioner uses it, and much too often. I have seen cases of what we generally term puerperal sepsis—the term to which Dr. Murphy objected and for which he wants to substitute a more definite pathologic term. I have seen three or four men of high standing in consultation over such a case and each of them interpret the condition in quite a different way. Therefore, it seems to me, just as Dr. Murphy and Dr. DeLee suggested, that so long as we are uncertain, so long as we cannot view the organs outside of the body, we should look for a method by which, even if we do make a mistake in interpreting the exact pathologic state, we shall do the least harm; and that, after all, is usually by the expectant treatment.

In abortions I believe that infection is often due to the hasty examination made by the general practitioner when the patient is bleeding and he fears that she will bleed too much. In the puerperal cases the greatest difficulty lies in our inability to rely on the statements of the attendant as to whether the entire placenta has been expelled. If we are sure that the placenta is outside of the uterus after labor, the further question of emptying the organ cannot arise.

DR. R. S. YARROS, Chicago: Not so very long ago every physician considered it his duty to empty at once the puerperal uterus if there was any suspicion of septic contents. That there were too many uteri curetted and that some of the results were bad, not only because of the use of the curet but because it was used carelessly and by inexperienced physicians, we all admit. It seems to me, however, that the present extreme fear of the curet in such cases is not justifiable since obstetricians in these days are being better trained in surgical work. Most cases in which we are called on to remove the product of conception are either clean, incomplete abortions or cases of sapremic infection, and in my experience I have for many years, after dilating the uterus thoroughly, emptied it with a medium-sized curet, irrigated with iodin solution and

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lightly packed with gauze with good results. It is a different thing in criminal abortion cases, in which there is more likely to be a streptococcus infection and in which the infection has probably gone beyond the uterus. Dr. DeLee and many of his followers believe that a slow emptying of the uterus, which is accomplished by packing, is the only right way of reaching such cases because of the good results that they have obtained, but I maintain that, in the proper hands, our method has just as good results and, in addition, the patient and the family are not kept in suspense about the outcome.

DR. J. B. DELEE, Chicago: Dr. Yarros seems to have taken the defensive most sharply of all those who have discussed the report, and therefore I may perhaps be permitted to reply to that particular onslaught. I will quote the experience of my associate and collaborator, Dr. Stowe of Chicago, whose experience was gained in the same institution with which Dr. Yarros is connected. Dr. Stowe had been taught that every septic case should be curetted and he carried out this idea when he came into the hospital. He noticed that all the patients died. So he left them alone and they all recovered.

In conclusion, I shall answer the questions in the circular myself. 1. In septic abortions I try to determine, from the history and symptoms, if there is any perforating injury of the uterus. In this case, the abdomen is opened at once; otherwise the uterus is lightly packed with iodized gauze. Next day the gauze is removed and, unless the cervix is fully dilated, the uterus is again packed for twenty-four hours. The uterus is then emptied by means of the ovum forceps and the finger. 2. The treatment is the same as No. 1. 3. After full term or near term labor the uterus is not invaded unless there is hemorrhage. The patient's shoulders are raised to favor drainage and hygienic treatment and good nursing are provided. 4. I do not believe in active interference at once. When I do empty the uterus, I remove large loose masses by means of the ovum forceps, locate small adherent pieces and separate them with the finger, and only exceptionally use the curet. 5. When hemorrhage complicates sepsis, I tampon the uterus, and repeat this again, or twice, if necessary. 6. In case the presence of ovular remnants is only suspected, I do not interfere. 7. I always try to distinguish between sapremic and septicemic states before operating, but have never felt sure in operating that I was not starting a fatal illness. 8. I make distinctions in the treatment of sepsis after abortion and that after full term or near term delivery. In septic abortions I feel much safer in invading the uterus with finger and ovum forceps, and in a few cases I use the curet—never after labor. I am growing more and more conservative in the treatment of sepsis, and am delaying the time of interference as much as possible, to give Nature time to erect a good barrier.

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HEMORRHAGE FROM THE NON-PREGNANT UTERUS

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Even a casual glance over recent literature indicates that the subject of uterine hemorrhage is so complex as to make practically impossible a comprehensive classification of causes. At the same time, the subject is simple enough to be readily understood. Such confusion indicates ignorance of the underlying principles of menstruation—its anomalies and abnormalities. Without accurate knowledge of the regular menstrual function, attempts to treat departures from the normal must depend almost entirely on empiric rules, the result of experience in practice. Such clinical experience, in the treatment of the various forms of uterine hemorrhage, I may claim without unduly violating the canons of modesty. It is on the result of this experience that I wish to speak.

In practice one meets hemorrhage from the non-pregnant uterus during the three important epochs of a woman's life—puberty, the child-bearing period and the menopause. Whatever the time of life at which such bleeding occurs, it may be said to depend on either local or constitutional causes.

Under constitutional causes we may at present include those little understood forms of hemorrhage supposedly due to interference with or departure from the normal in the internal secretion or secretions of the ovary and other ductless glands. Such abnormality may be presumably in the quality, quantity or regularity of the

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secretion, but the bearing on treatment has not yet been determined.

Other better understood causes are chronic visceral diseases (heart, lung, liver and kidney), infectious fevers, syphilis, general arterial sclerosis with high blood-pressure, leukemia, hemophilia and essential anemias, including chlorosis.

In any given case of uterine hemorrhage without easily demonstrable local cause, these various factors should be ruled out before one resorts to the ubiquitous and overworked curet. Curettage in these cases is of no permanent value, although it may lessen temporarily the menorrhagia and metrorrhagia. Such improvement is, however, always transitory. It may be interesting to mention that Whitehouse reports 20 per cent. of failures in a large number of patients submitted to curettage, indicating that one woman in five has been subjected to operation unnecessarily—a strong indication against the prevalent methods in diagnosis and treatment of uterine abnormalities.

Treatment in cases of menstrual anomalies of constitutional origin resolves itself into treatment of the underlying causes. Menorrhagia and metrorrhagia are only two of the many local indications of a general condition which requires the adoption of proper hygienic and therapeutic measures for its relief or cure. The local symptoms require local treatment in very few cases.

There are certain cases, however, without demonstrable local or constitutional causes, which, for want of a better term, are usually considered cases of endometritis. Curettage cures them and the scrapings show the well-known appearance of hyperplasia and hypertrophy of the endometrium and its glands. It is very probable that a certain number of these cases arise as the result of a mild superficial infection, and this is especially to be considered if the patient also has leukorrhea.

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Every method of diagnosis should be exhausted, including bacteriologic examination of the uterine cavity, before a patient is relegated to the class of those suffering with "simple endometritis"; and, for reasons to be considered later, girls during adolescence are never included in this class.

Local causes of uterine hemorrhage include practically every form of disease which may occur in the pelvis; infections of the uterus from gonorrhea or after puerperal sepsis, myoma, polyp and cancer, tears of the cervix, retrodisplacements, tubal, broad ligament, tubo-ovarian and ovarian disease. In this connection it must be remembered that bilateral ovarian tumors, particularly carcinoma, frequently cause amenorrhea as a result of complete destruction of ovarian tissue. Constipation is included among the local causes for the reason that it produces uterine congestion by mechanical obstruction to free venous flow from the pelvis.

Whether both local and constitutional causes produce hemorrhage by setting up a so-called endometritis or by their action on the vasomotor or muscular mechanism of the uterus, I am unable to say. Such hypertrophy and hyperplasia of the endometrium is almost always demonstrable in these cases, but it is also often present when there is no menstrual abnormality, and occasionally, in spite of the fact that there is free bleeding, atrophic instead of hypertrophic changes occur.

Whenever there is a demonstrable local cause for hemorrhage, such as lacerations, displacements, tumors, etc., treatment is simple and easily determined on. Indications for operation are obvious and the extent of the operation is determined by the amount of disease. In all cases in which the uterus is not to be removed, curettage should always be performed, as this hastens the return to normal. These easily recognized and treated forms of hemorrhage occur with greatest frequency during the child-bearing period and a large number of them are a direct result of parturition.

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Puberty and the menopause furnish us with the most difficult and puzzling forms of hemorrhage and the ones which are at the same time the most resistant to treatment.

The onset of the menstrual cycle is a critical period in a girl's life, when her nervous and bodily functions are readily and perhaps permanently unbalanced. The greatest care is necessary in the treatment of any abnormalities of sexual organs, as nervous shocks of any kind are likely to develop a morbid mental attitude toward the menstrual and sexual life. Pelvic examinations and local treatment can and should be avoided in all but the most exceptional cases. This applies even to patients who have been anesthetized. It is a question if anesthesia is advisable, because the preanesthetic and postanesthetic periods are usually associated with the rapid development of fanciful ideas which may have a lasting effect on the sensitive mental organism of the adolescent. Delay in resorting to examination and explanation by the patient's mother of the object of the examination, with a minimum of manipulation at the time, are better safeguards than anesthesia in all but exceptional cases. Rectal examination may sometimes be substituted for vaginal.

Hemorrhage at puberty, the so-called virginal menorrhagia and metrorrhagia, may of course depend on a local cause, such as infection, ovarian disease, etc., but such cases are comparatively rare. The majority are cases of "essential" hemorrhage.

The causes of these essential hemorrhages are numerous and varied. Sufficient mention has already been made of the common constitutional causes, although mitral stenosis probably deserves special mention. Hemophilia, which, contrary to general belief, is not uncommon in a mild form among women, may manifest itself by uterine hemorrhage at puberty; I have seen this prove fatal. So, too, chlorosis and congenital syphilis may cause irregularities at the onset of menstruation.

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A factor in menstrual hemorrhage that is worthy of more consideration than it receives at present is the estimation of the calcium index. There is undoubtedly a close connection between the calcium metabolism and menstruation (Blair, Bell). Hyperthyroidism is another cause of increased and irregular bleeding at puberty.

Anomalies of ovarian function in regard to its internal secretion are frequently accused of causing menstrual irregularities in early life. Dalche's explanation is that rapid growth of the body and sudden development and maturation of the ovary unsettles the normal equilibrium and causes a condition of "ovarian ataxia" in which periods of hyperfunction alternate with periods of functional inactivity. This form of "ovarian" hemorrhage is not to be confused with that due to macroscopic disease of the ovaries.

It is apparent that there are two distinct sides to the treatment of uterine hemorrhage at puberty; one the treatment of cause and the other treatment of the acute condition, as at times bleeding is so free that the patient's health is markedly affected.

Treatment of the underlying cause varies in the individual case. No definite rules can be determined on. Girls with a low calcium index should receive from 10 to 20 grains of calcium lactate three times a day. This is the only drug that can be said to have a definite indication, although the list of drugs used is of formidable size, some being administered with the idea of overcoming the underlying cause, others to stop the hemorrhage. Among these may be mentioned ovarian, adrenal, thyroid and pituitary extracts, animal serum, ergotin, hydrastin, stypticin, etc.

The starting place in the treatment of these cases of "essential" uterine hemorrhage is the axiom that such a case should never be curetted. The most essential part of the immediate treatment is rest in bed. Nothing tends to control hemorrhage so effectually. Many

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men order in addition hot vaginal douches. This is justifiable in married women, but, like all other forms of local treatment, should be avoided in unmarried girls. If it is desired to have the local effect of heat it is best obtained by hot rectal injections, and it is questionable if even these are advisable, as the application of an ice-bag to the abdomen is much more efficacious.

In this connection I should like to state my conviction that routine vaginal douches do more harm than good in most instances. They are one of the many forms of local treatment that increase the number of women suffering from the various sexual psychoneuroses. Many women, married and unmarried, can trace the development of sexual types of mental abnormalities to well-meant but injudicious local treatment. Women doctors are marked offenders in this direction with frequent, unnecessary vaginal examinations, weekly changes of pessaries, and the routine prescription of self-administered vaginal douches. Digital massage of the uterus is a favorite treatment of some osteopaths, with what disastrous results can readily be imagined.

The use of x-rays, which might be expected to have some influence on these cases of hemorrhage, is contra-indicated because of their destructive effect on the ovaries. In hyperthyroidism ligation of the vessels or excision of part of the gland might be expected to result beneficially, and that they do not is probably because the symptoms are due more to disordered than excessive secretion. There is a strong reaction against thyroid operations in early life, at least until prolonged and intelligent attempts have been made to control symptoms by hygienic treatment. Gelatin given subcutaneously or by mouth has been recommended. Its use by the former method is dangerous from the standpoint of sepsis, and the latter method is uncertain, although it is said to increase the coagulability of the blood. Electricity is objectionable because it is a form of local treatment.

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It seems that we are reduced, therefore, to the effects of rest, quiet, free action of the bowels, ice, calcium, or other drugs as they seem to be indicated; and, above all, the beneficial effects of time, for improvement or cure of these obstinate cases of uterine hemorrhage at puberty.

Again let me sound a warning against curettage and other forms of local treatment. They not only do no good but are distinctly harmful, and are the basis of many of the psychoneuroses that our friends the psychiatrists are revealing to us out of the old order of surgical neurasthenia.

Hemorrhage at the menopause presents problems of a different nature. Irregular and excessive bleeding at this time puts on the attending physician the burden of proving the absence of carcinoma of the cervix or body. For this reason curettage is indicated—in fact, it is imperative—in every case of this description, as it is by this means only that carcinoma of the body can be ruled out. Inspection and section for microscopic examination suffice for the diagnosis of cancer of the cervix.

The treatment of these forms of hemorrhage consists in as complete a panhysterectomy as possible. But these are not the cases that cause trouble and anxiety in diagnosis and treatment. There is a class in which physical examination shows little or no abnormality in the uterus and its appendages; curettage reveals a normal endometrium or a moderate amount of simple endometritis, yet the bleeding continues and becomes more instead of less frequent and severe. These are the cases that have caused the adoption of numerous methods of treatment, all aiming to avoid the necessity for hysterectomy.

The cause usually given for the hemorrhage is sclerosis of the uterine vessels, distinct from and not to be confused with a general arteriosclerosis. The greatest change is in the adventitia and media. The

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adventitia is greatly increased by the deposit of fibrous tissue, which also involves the surrounding tissue, giving rise to a peri-arteritis. The media is diminished in size because the muscle is replaced by fibrous tissue. The intima is not involved and the lumen of the vessel not encroached on, a differential point from syphilitic atheroma.

This sclerosis may exist independently or be associated with more or less intermuscular fibrosis, which may go to the length of supplanting a certain amount of muscular tissue. These variations in the pathology probably account for the difference in the physical signs in individual cases. In some the uterus is small and apparently normal to examination, in others it is large and soft, and in still others it is large and very firm. The sclerosis of the vessels is common to all three forms and is believed to be the offending agent in the causation of hemorrhage. Simpson believes that the condition of the myometrium plays a greater rôle in the regulation and prevention of hemorrhage from the uterus than the vessels. The sclerosis observed in these cases could readily so interfere with the tonic contraction of the uterine muscle as to prevent occlusion of the vessels by muscular action and thus permit excessive loss of blood.

The various means that have been employed to overcome bleeding of this description have as their object preservation of the uterus and the maintenance of the normal menstrual flow. This is of course an advantage in younger women, in whom this condition is said to occur with greater frequency than at first supposed.

Curettage is always the first step in the treatment of these cases, to enable one to exclude carcinoma. On this point every operator is agreed. Subsequent treatment marks the particular predisposition of the individual surgeon.

To mention non-operative methods first, the x-ray and electricity are the most prominent contenders for

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popular favor. Several observers have had varying degrees of success in controlling hemorrhage by the use of x-rays. They act by causing atrophy of the ovaries and subsequent atrophy of the whole genital tract, including the uterus. For cases in which operation is refused or contra-indicated there is no doubt that the x-rays offer a fairly satisfactory method of treatment, but in my experience one not always to be relied on. There is a fairly large percentage of failures and thus valuable time may be lost. On account of their effect on the ovaries, the x-rays cannot be used on young women.

Electrical treatment has various advocates (particularly Hirst). I have had no experience with it except in meeting cases that have relapsed after a more or less prolonged period of freedom from symptoms after a course of electrical treatment. I have never been able to persuade myself that there is any field for such treatment.

Atmocausis, the application of live steam to the uterine cavity, has occasional advocates in various parts of the world, who are all positive in their statements that good results can be obtained by its use, particularly in cases that occur during the child-bearing period, when radical treatment is to be avoided if possible. In these cases the endometrium is cooked, but not sufficiently to cause subsequent sloughing. At times destructive atmocausis is undertaken with the view of causing complete occlusion of the uterine cavity by sloughing and subsequent adhesion.

The action of the steam is difficult to regulate to just the required degree and the prevention of infection is almost impossible. I myself have no faith in the ability to cure by atmocausis any but the very mildest cases of hemorrhage and feel sure that any field of usefulness it has is extremely limited. I never use it.

Of other forms of treatment, hot air, vibratory massage, active and passive hyperemia, zinc injections and

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animal serums I have had no experience. It would be impossible for any one man to try all the methods that have been advocated, and each operator must work out for himself his own views.

Occasionally one of these patients bleeds so freely that immediate local treatment is necessary. Plugging the uterine cavity and vagina with gauze will always stop the bleeding, but should be done only when asepsis is sure. Under other circumstances a vaginal plug, firmly pushed home into the vaginal fornices, is safer and practically as certain of stopping hemorrhage.

Most of the obstinate cases of uterine hemorrhage that fall into my hands have been the rounds of various "specialists," who have put them through all the different recognized and unrecognized forms of local, general and absent treatment. These patients come to me with a vigorously expressed desire for cure, having been thoroughly disgusted by the time and money they have wasted without getting relief.

Naturally these represent the failures of other treatments, and it may be that my experience has made me too skeptical of the value of forms of treatment other than operative, as I never encounter the successes of the conservative methods.

I believe that in a well-marked case of uterine hemorrhage due to sclerosis of the vessels, complete removal of the uterus is the only sane treatment.

I wish particularly to direct attention to the advantages of a preliminary hysterotomy in certain cases. I advocated a year ago in this Section hysterotomy as the operation of choice in placenta praevia; in occasional neglected cases of the toxemia of pregnancy and in certain cases of menorrhagia and metrorrhagia in which carcinoma and gross disease of the uterus appeared not to be a factor. By thus opening the uterus I have on several occasions disclosed a non-malignant polypoid condition of the endometrium which could be much more thoroughly treated under direct

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inspection than by blindly curetting from below through the os. Occasionally, also, one or more fibroid nodules may be discovered beneath the endometrium and removed with ease. The usual method of curetting could hardly be successful in the removal of these small submucous myomas. I have had no mortality from hysterotomy and believe it to be an operation deserving of wider application. Practically the only danger of any moment is that of infection of the abdominal cavity. If the uterus and the field of operation be well walled off with gauze pads this danger may be minimized, even in the presence of an infected uterine cavity. It must be remembered that the operation of hysterotomy, partial or complete, is not free from the dangers of infection. Still, I would not venture hysterotomy in the case of a boggy uterus evidently the seat of metritis. This condition is rare, however, and it is my belief that the risk of infection following hysterotomy is greatly magnified by the objectors to the operation. Having had great satisfaction from the operation in selected cases, I do not hesitate to employ it and to recommend it to experienced surgeons.

The question of the desirability of complete hysterectomy is settled by the patient's age, degree of uterine disease and the chances of the subsequent development of carcinoma. In women of 40 or over I never hesitate to do the complete operation, as the uterus is of no actual use to most women of this age. I remove the ovaries at the same time, as they may be the cause of symptoms, and, while they cannot cause hemorrhage after the removal of the uterus, they are still a potential menace to subsequent good health by their tendency to tumor formation and the possibility of the perversion of their internal secretion. Occasionally in operating for a supposed uterine cause of hemorrhage one finds an ovarian hematoma or hemorrhage into a lutein cyst, which is probably the fundamental cause of the hemorrhage. I do supravaginal hysterectomy and appendectomy in these cases.

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SUMMARY OF CASES STUDIED

The total number of cases studied was 227.

Sixty-nine cases of fibromyoma uteri and 2 cases of carcinoma uteri which never presented symptoms of menorrhagia or metrorrhagia.

Forty-five cases, pathologic diagnosis of endometritis. Operations performed: complete hysterectomy in 5 cases (past menopause); anterior hysterotomy and curettage in 1 case; vaginal hysterectomy in 2 cases; dilatation and curettage in 37 cases.

Twenty-one cases, pathologic diagnosis of fibromyoma with endometritis. Operations performed: supravaginal hysterectomy in 17 cases; complete hysterectomy in 3 cases; vaginal hysterectomy in 1 case.

Twenty-four cases, pathologic diagnosis of carcinoma. Operations performed: complete hysterectomy in 12 cases; supravaginal hysterectomy in 4 cases; dilatation, curettage and cauterization in 1 case; dilatation and curettage in 1 case; cauterization in 1 case; vaginal hysterectomy in 1 case; 4 cases inoperable.

Forty-four cases, pathologic diagnosis fibromyoma. Operations performed: supravaginal hysterectomy in 31 cases; complete hysterectomy in 7 cases; anterior hysterotomy in 2 cases; myomectomy in 3 cases; vaginal hysterectomy in 1 case.

Two cases, pathologic diagnosis sarcomatous degeneration of fibroid uteri, supravaginal hysterectomy being performed in both cases.

Mortality.—Four deaths, all occurring in cases of carcinoma. In one carcinoma also involved the sigmoid and the patient developed fecal fistula; one patient died of uremia and two of toxemia.

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ABSTRACT OF DISCUSSION

DR. LEWIS S. MCMURTRY, Louisville: A point on which I would differ from Dr. Deaver is regarding anesthesia of virgins for examination of the uterus. It is practically impossible to make a satisfactory examination without anesthetizing the patient. She is unable to control the voluntary muscles and the resistance is such that examination is impossible. I would emphasize Dr. Deaver's statement that hysterotomy should be a means for diagnosis only in the hands of experienced surgeons. In the hands of men accustomed to opening the abdomen every day it is a safe procedure, and in many cases it is justifiable. As a routine procedure it would be a very dangerous practice. All of us who have operated for fibroma have opened the uterus to

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find that all the hemorrhage was caused by a small polyp in the fundus and that hysterotomy would have reached it. Hysterotomy as an exploratory operation for cancer of the uterus is seldom necessary.

Dr. Deaver rendered special service in calling attention to two salient points: (1) that this symptom should be dealt with as a symptom; (2) that there should be a thorough investigation made of every woman who has a persistent uterine hemorrhage to find the pathology and deal with it in a surgical way. I would especially commend the suggestion which Dr. Deaver makes as to young women at puberty, who have persistent hemorrhage without demonstrable lesion of the uterus or its appendages. Rest and general systemic treatment should be observed rather than resort to indiscriminate dilatation and curettage and other active surgical treatment. In conclusion, it is neccessary to reiterate the oft-repeated warning as to the vicious practice of resorting to the curet indiscriminately for uterine hemorrhage. Curettage is more abused to-day than any other surgical operation and does more harm.

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ABDOMINAL ADHESIONS

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Every surgeon of experience has been impressed by the fact that certain patients are apt to form extensive adhesions following the simplest operation, done under perfect aseptic conditions, while other patients fail to form adhesions no matter how much the traumatism, nor how imperfect the technic. He has also found that certain patients will seemingly withstand a great amount of sepsis, while others die from very slight infections.

I have done a great deal of experimental work in the abdomens of both hogs and dogs, and have been impressed by the fact that hogs form extensive adhesions with the slightest provocation, while dogs do not form extensive adhesions as a rule. I have been equally impressed by the fact that hogs rarely die of sepsis, while dogs are very susceptible to infection, as proved by the fact that the farmer unsexes his sows without any preparation; without even washing his hands, which often contain every germ known to bacteriology; uses a piece of twine which he may find in the barnyard for closing the abdomen, and yet rarely has suppuration in the abdominal wound, and almost never has an animal die from peritonitis; while on the other hand, it is found that in unsexing bitches under the same circumstances, the great majority of them die. In other words, the hog with his tremendous resistence and rapid reparative processes, forms adhesions, but these adhesions are the result of the same beneficent process which so perfectly destroys the septic material. On the other hand, the dog dies because of a lack of these elements and process which form adhesions.

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A statement may then be made, that it is better to be a live hog with adhesions than a dead dog without adhesions. Adhesions may play a beneficent rôle or a harmful rôle. The process is beneficent in the first place, but in certain instances the adhesions may become harmful after their beneficent office has been fulfilled.

It is true in all the practice of medicine and surgery, that the physician's work is chiefly auxiliary. He cannot prevent the formation of adhesions, and it is well; but he can modify an excess of adhesion forming, or remove the harmful adhesions after they have formed.

About four years ago the late Joseph Price read, before the Southern Surgical Association, a paper entitled "Surgical Junk," in which he discussed the post-operative adhesion question. "Surgical junk" is a very expressive term, for the adhesions following reparative processes simply represent material that was brought to the scene of action for a purpose, and now has no further use. I have had the literature of this subject completely abstracted at the Surgeon-General's office. The most striking features of the literature are in its monotony and its inconsistency. All authors have discussed prevention, e. g.: all authors have discussed the wet and dry protective pads, one maintaining that he had performed 132 laparotomies with dry asepsis, with ten deaths, five of which were due to intestinal obstruction, while in seventy-six cases treated with moist asepsis, he had two deaths and no intestinal obstruction. An equally prominent authority reported 481 laparotomies with dry asepsis, and only one fatality from ileus, while with moist asepsis he had a very much higher rate. Other operators assert that exposure to the air is the principal cause of adhesions; others that trauma is the principal cause, and still others that sepsis is the chief cause. Every variety of lubricant that has ever been known has been used by ardent advocates to prevent adhesions, and condemned even more ardently by others who have tried them. Some have used prepared membranes with good results, while others equally prominent

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get no results. Some have no adhesions by using cathartics; others get equally good results by absolute rest treatment. By carefully considering all the literature which has been written, along with my own limited personal observations, I think we may safely reach the following negative deductions:

1. The choice between the wet and dry pad is not vital, if equal care is used in their use.

2. Oils and all lubricants are worse than useless in the prevention of adhesions.

3. Specially prepared membranes and other foreign bodies have not proved equal to the claims of their advocates.

4. Cathartics following operation probably do more harm than good as a rule, although at times they may be of benefit.

On the other hand, we are safe in the following positive deductions:

1. Thorough asepsis.

2. As little handling as possible.

3. Avoidance of all traumatism and exposure to the air, as far as can be.

All of these agencies and precautions undoubtedly have an influence, but of greater importance is the special resisting power of the patient. Adhesions forming under given circumstances probably are in exact ratio to the patient's power of resistence to sepsis. Adhesions ordinarily do no harm as far as the patient knows. Adhesions do harm only when they impair the motility of a normally movable organ, and prevent it from performing its normal function. Adhesions which tend to disturb the normal relation between a freely movable and a relatively fixed portion of the gastro-intestinal tract often produce a partial obstruction at these points. Therefore, troublesome adhesions often form in the neighborhood of the pylorus and gall-bladder, and in the neighborhood of the iliocecal valve and near

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the ligament of Treitz after gastro-enterostomy. Troublesome adhesions often form between the small intestines and the pelvic organs, which are located in a deep cavity, and which have a direct communication with outside infection. Adhesions to the pelvic organs, or a low abdominal wound, in cases in which extreme gastroptosis already exists, are of the most troublesome variety. Troublesome adhesions resulting from gall-bladder diseases, or an operation for gall-stones, hold the stomach in such a position that it cannot empty itself properly. On the other hand, adhesions which do not prevent the free passage of gastro-intestinal contents do no harm and are not noticed, as is shown by the fact that gastropexy, as performed by Rovsing, gives no evil symptoms. Any portion of the movable part of the intestinal tract may be sewed for any distance to the abdominal wall without giving symptoms.

The methods of treating troublesome adhesions, which seem to be based on sound principles, are as follows:

1. Cover all denuded areas with adjacent peritoneum as far as possible, either to prevent or cure adhesions. This may be done (*a*) by simply bringing peritoneal edges of denuded areas together; (*b*) by rolling the intestine partially in its own mesentery; (*c*) by splitting the mesentery into its two leaves and bringing one leaf up over the denuded surface of the intestine, as recommended by Richardson.

2. If a sufficient quantity of adjacent peritoneum is not available, a part of the omentum or mesentery may be inserted between the two organs and fastened by sutures. This method is applicable, (*a*) in the treatment of troublesome adhesions in the neighborhood of the pylorus and gall-bladder by bringing up the right-hand edge of the great omentum and suturing it to the lesser omentum, thus permanently separating the liver and gall-bladder from the duodenum by a layer of fat (Fig. 1); (*b*) in the treatment of adhesions or bands in the neighborhood of the ligament of Treitz, following

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posterior gastro-enterostomy, by first cutting the adhesions and then folding the peritoneum under the colon in such a way as to cover the site of the operation and to extend an inch or two down the jejunum, covering it; (*c*) in the treatment of troublesome pelvic adhesions, by suturing the sigmoid and its mesentery in such a manner as to wall off the pelvis, as recommended by Summers.

3. If peritoneum and fat are not conveniently available, the next step is to hold the organ away from the point of attachment, after the adhesions have been cut, by shortening its normal supports, or by suturing the organ or its supports to some other peritoneal surface in such a way as to assure proper function to the organs involved. This is applicable (*a*), in the treatment of adhesions or bands in the neighborhood of the iliocecal valve, as shown in Figures 2 and 3, in which, after the adhesions are cut, the mesentery of the ileum has been shortened so as to make it impossible for the former position to be reoccupied; this is made more easily effectual by putting patient on left side with foot of bed elevated 15 inches; (*b*), in the treatment of severe adhesions in the gall-bladder region, due either to gall-bladder disease or operative wound in the neighborhood, in which the stomach is distorted (Fig. 4); in this case, after the adhesions are cut, the gastro-hepatic omentum is plicated and shortened enough to hold the stomach away from its original point of attachment (Fig. 6); (*c*), in cases of ptosis which existed prior to an inflammatory process, by which process the omentum has been firmly fastened to the pelvic organs or to an operative wound in the lower abdomen, in such a way as permanently to fix the stomach and transverse colon low down in the pelvis, and thus prevent their proper emptying (Fig. 5). In these cases the greater omentum is sutured to the abdominal wall midway between the umbilicus and ensoform cartilage, and the upper abdomen expanded, thus curing the ptosis as well as the evil effects of the adhesions.

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4. In cases of excessive adhesions in the pelvis or other parts of the abdomen, in which a loop of intestine goes into a mass of adhesions and emerges, leaving plenty of clear intestine above and below, by far the best plan is to leave the adhesion alone and short-circuit by making a lateral anastomosis between the two limbs, as shown in Figures 7 and 8, which operations I have done repeatedly, when the adhesions had gone to the point of producing intestinal obstruction. I may state that all of these patients have remained in perfect health, although the adhesions were permitted to remain without disturbance.

5. In addition to the foregoing methods, I now submit a fifth method of treating adhesions in well-marked adhesion-forming patients, in whom adhesions recur after operation, in increasing quantity. It is the insertion of a protected gauze pack. For the past ten years I have used a gauze pack in certain septic conditions, with a great deal of satisfaction. In my early cases I used the gauze wicks without protection, which had the disadvantage of sticking to the loops of intestine and often paving the way for subsequent hernia, for I found that a little more than 25 per cent. of cases thus drained later developed hernia. During the past six years I have protected the gauze pack by several layers of rubber tissue, and by so doing I find in examining my records that the hernia have been reduced to a little more than 5 per cent. This drainage has been used in cases of acute sepsis, involving an area which could not be removed. I have used this pack during the past ten years in more than two hundred cases. In cases in which it has been necessary to open the abdomen for some other reason afterward, I have been particularly struck with the fact that adhesions are absent to a remarkable degree, and I believe I am safe in saying that the adhesions are less than in the average clean case in which the abdomen is closed without drainage. After observing this absence of adhesions following the use of the quarantine pack, I decided to try it for cases of extensive adhesions, in which the

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patient had been repeatedly operated on. Every surgeon knows these cases, and knows how he opens the abdomen, dissects adhesions sometimes for hours, possibly opens the intestine several times, closes the intestinal wounds and closes the patient with fear and trembling, expecting sepsis to follow. Sepsis does not follow; the patient recovers temporarily, but soon begins to show evidences of the reformation of troublesome adhesions. He finally opens and repeats his dissection with the same results. In this class of cases the protected gauze pack does its best work. It is placed as follows:

TECHNIC OF GAUZE PACKS

All the intestines must be temporarily packed far away from the infected or denuded area or organ. Gauze wicks the size of a finger should be laid straight, side by side, reaching entirely across the abdomen and coming out through the drainage opening. Four or five layers of gutta-percha tissue are then placed above the gauze and allowed to come out through the opening also. The intestines are now allowed to come down against the rubber tissue (Fig. 9). The omentum is drawn down, and if long enough is interposed between the rubber tissue and intestines (Figs. 10 and 11). The pack is brought out at the lower angle of the wound, and the upper part of the wound closed snugly around it, with combined layer and through sutures.

In my experience it has been better to attempt to remove half or all of the gauze wicks about the sixth or seventh day after the drain is placed. If the gauze is removed before the end of six days, it is usually done with difficulty. If it is allowed to remain more than ten days it again attaches itself and is removed with difficulty, so that at the end of about six days it will usually be found that the wicks are pulled out more easily than they are either sooner or later. At times I remove all of the gauze at this date, and at other times leave about one-third of it and take it out about three days later. I rarely remove the rubber tissue earlier than ten days or later than fourteen days. At this time I remove all of the rubber tissue and slip in a small soft rubber tube, tapered at the end, which prevents the adbomen from closing over the cavity before it is healed. This is allowed to remain a week or ten days, until the bottom of the opening has time to close in around the tube and make a straight sinus. If this last tube is not allowed to remain long enough, the wound heals on the outside and leaves a large unhealed cavity on the inside, which makes the wound very much slower in closing.

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About five weeks is the average time for a wound thus treated to heal entirely. I usually keep the patients in bed for about four weeks.

No procedure in all of my abdominal work has given more complete satisfaction. In no case has it ever been necessary to reoperate for adhesions after the use of the protected pack. The pack seems to serve two purposes. First, it rapidly drains off serum, and with it the adhesion-forming plastic material, which seems to be excessive in these adhesion-forming patients, so that there is not much material to form adhesions. Second, it creates double lines of granulation, which apparently are incapable of uniting with each other firmly.

789 Glisan Street.

ABSTRACT OF DISCUSSION

DR. J. H. JACOBSON, Toledo, O.: Dr. Coffey's theory seems to me in direct contradiction to our ideas of the formation of abdominal adhesions. The work done by Dudley and Sargent is the best on this subject. They point out that adhesions are formed from plastic exudate thrown out on the intestinal walls about the site of the operation. They maintain that with proper drainage and removal of the serum and exudate adhesions are prevented. The other principle is that the introduction of all foreign substances or anything which will destroy the endothelium of the peritoneum will produce adhesions. The conclusions of Dr. Coffey seem to me in contradiction to these principles.

Can we account for the formation of adhesions in these cases? Will a timely operation, even in the presence of an enormous amount of infection, with properly placed drains lessen the tendency to adhesions? We can prevent the further destruction of the endothelial covering of the peritoneum and prevent adhesions? This is a most important principle and one which we should work on in doing abdominal surgery. It is important to do away with dry packs and to use the moist. In the gall-bladder operation, with the use of the Mayo-Robson position the abdomen is closed before the patient is put back in the horizontal position. We have noticed adhesion of the liver to the parietal peritoneum and part of the diaphragm. We have separated the adhesions and used the omentum. When it is necessary to use a substance to prevent adhesions in the abdominal cavity, Dr. Coffey has shown that he prefers that method to the use of foreign materials. I also wish to mention the danger of adhesions from the contact of the intestines with the iodin. Because of this, the skin should be covered with gauze so that the

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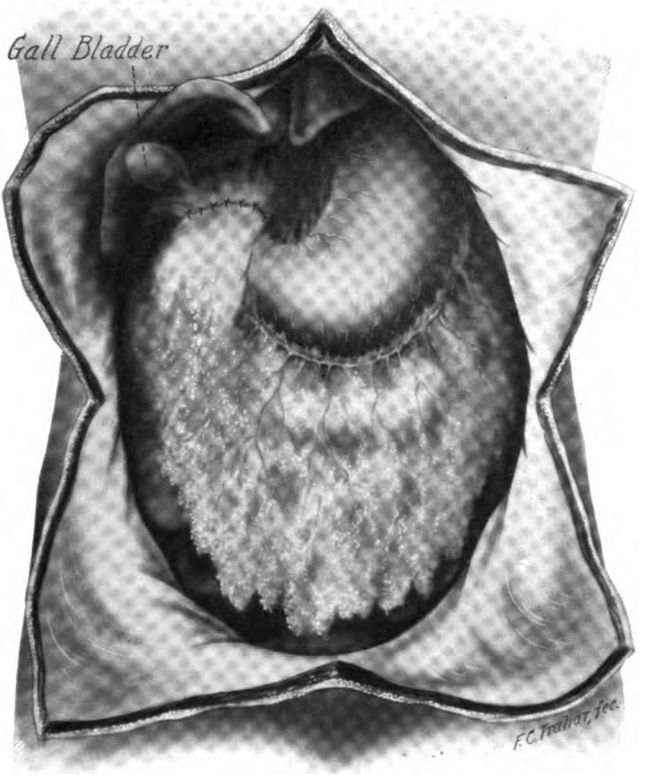

Fig. 1.—Reflected free edge of greater omentum sutured to lesser omentum for the purpose of separating the gall-bladder from the duodenum, thus preventing the reformation of adhesions.

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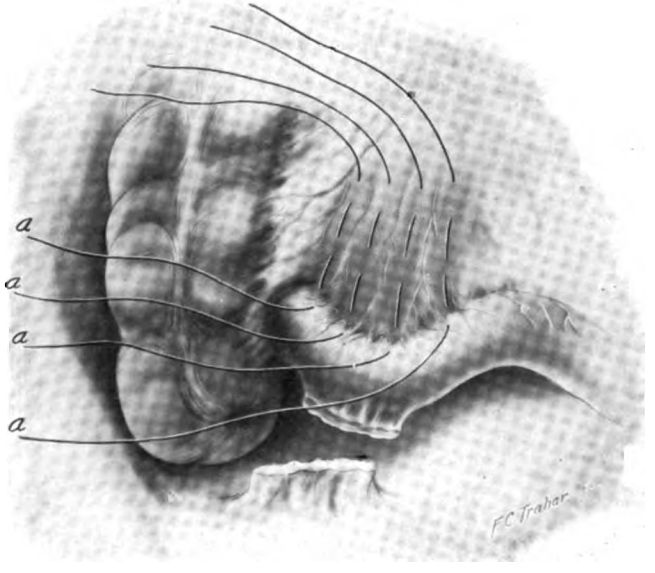

Fig. 2.—Method of applying purse-string sutures for the purpose of shortening the mesentery of the ileum to prevent reformation of Lane's bands; (*a*), purse-string sutures.

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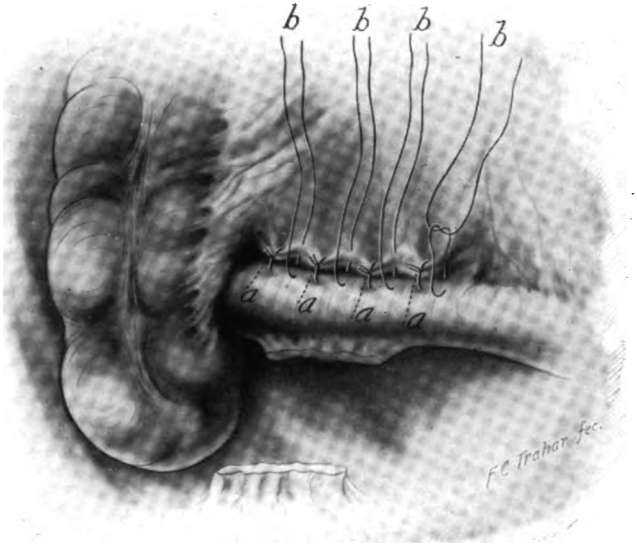

Fig. 3.—Purse-string sutures (*a*) tied; reinforcement sutures (*b*) placed between.

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Fig. 4.—Stomach held down and distorted by postoperative or other adhesions thus preventing proper emptying. This condition may be relieved by the Beyea operation, as shown in Figure 6, or interposition of the greater omentum (Fig. 1).

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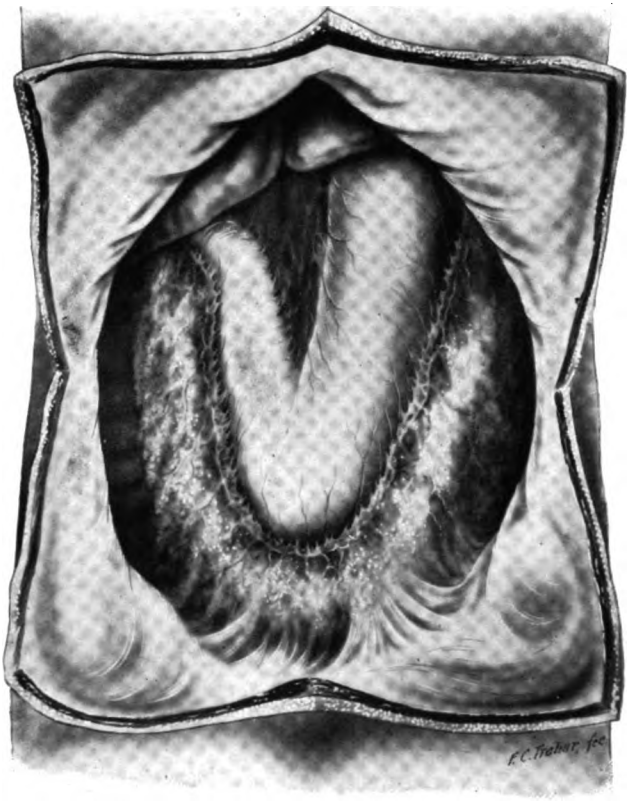

Fig. 5.—Midline ptosis made permanent by adhesion of the greater omentum to the lower abdominal wall or pelvic organs following inflammatory condition or surgical operation in patient who was previously afflicted with ptosis.

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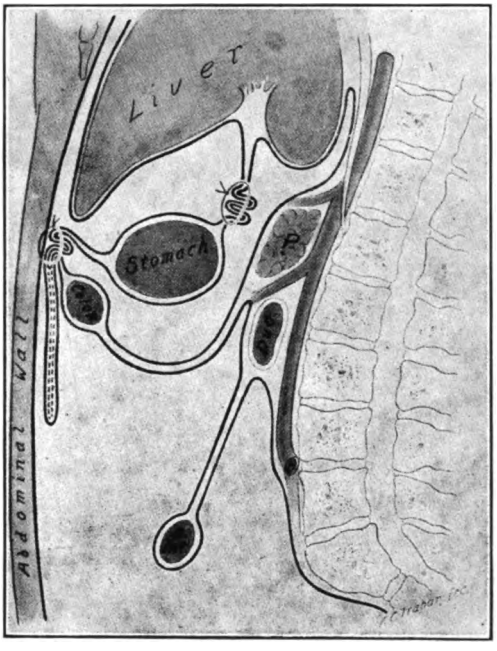

Fig. 6.—Lesser omentum shortened (Beyea). Greater omentum sutured to abdominal wall (see *Surgery, Gynecology and Obstetrics*, October, 1912).

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Fig. 7.—Relief of complete obstruction, due to extensive pelvic adhesions, by short-circuiting.

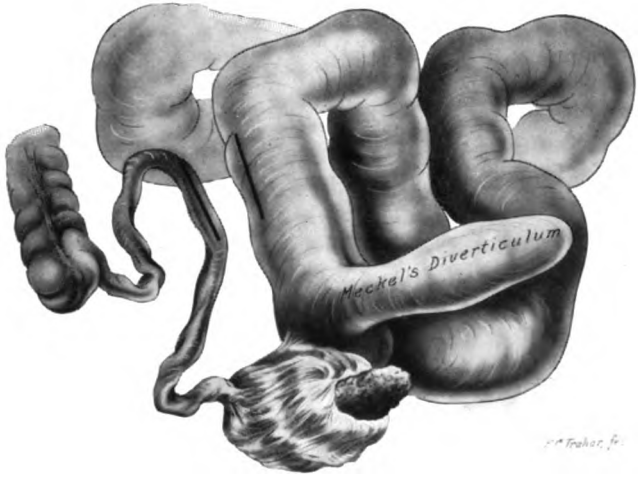

Fig. 8.—Relief, by short-circuiting, of complete obstruction due to adhesion of intestines around a mesenteric stone which weighed a little more than 2 ounces. Note Meckel's diverticulum.

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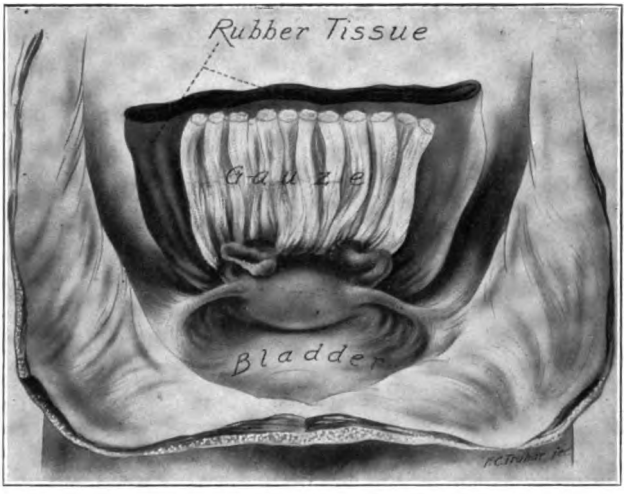

Fig. 9.—Gauze wicks protected by rubber tissue placed in pelvis. Note that an infected tube has been split and allowed to come in contact with the drain. This procedure is not advisable in gonorrheal pus tubes.

Fig. 10.—Protected gauze pack has been placed and omentum interposed.

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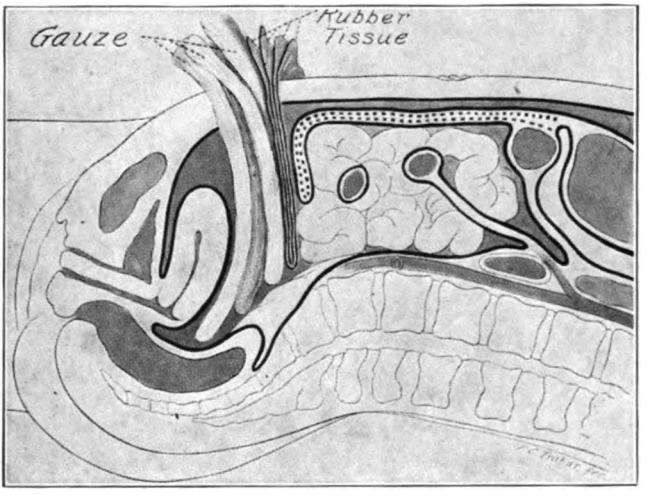

Fig. 11.—Scheme of protected gauze pack as applied to the pelvis for the relief of extensive adhesions.

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intestines will not come into contact with the skin. I am much interested in this quarantine pack because we are introducing into the abdominal cavity foreign material, and yet, apparently, with the draining off of the serum we prevent the reformation of adhesions. This is contrary to the usual view of the formation of adhesions. We must wait and hope that it will prove to be as Dr. Coffey has told us to-day.

Dr. John B. Deaver, Philadelphia: I have saved many lives by the procedure described by Dr. Coffey. I have had thirteen cases following appendicitis. All the patients were operated on and all recovered, and I did not interfere with the adhesions at all. That is masterly inactivity, conservative surgery. More radical surgery would be likely to result in disaster. In place of the quarantine pack, we formerly used rubber tissue. The principle is the same. There is no question at all that the convalescence is less interrupted and more permanent. I was also glad to hear Dr. Coffey say that he did not take the gauze out until from the sixth to the eight day. I tell my house-doctors to leave it in until it practically comes out.

Dr. Rufus B. Hall, Cincinnati: This gauze protection in pus cases is a life-saving operation. Do not be afraid of adhesions if you use gauze. I have used this method for twenty years. I did not at first protect with rubber tissue, but find it a distinct advantage. I learned early in my work not to remove the gauze too soon. I handle it as Dr. Deaver does and wait until it becomes loose; in from six to seven days it can be removed easily. The hernia, if it occurs, can be treated afterward without trouble. I tell my patients that I expect them to have a hernia, but that it can be repaired. By this method we can save lives that would otherwise be lost.

Dr. C. E. Cantrell, Greenville, Tex.: Do not break up these adhesions, if you can secure a loop of intestine for anastomosis, because otherwise some of the bowel will be denuded of its peritoneal covering. I have worked for hours trying to cover raw surfaces with peritoneum. I have in mind a case in which we operated a fourth time. We did not disturb the adhesions, but did an anastomosis and the man recovered.

Dr. Henry Boxer, Birmingham, Ala: The principal thing in abdominal surgery in the prevention of adhesions is to cover all raw surfaces, no matter how much time it takes, unless the patient's condition is bad and we have to finish the operation in a hurry. In pelvic surgery, when adhesions of the intestines are extensive, Dr. Coffey has mentioned that he does not disturb the adhesions, but makes an end-to-end anastomosis. If there is no obstruction to the intestines, the best plan is to leave the adhesions alone rather than to disturb them by making an end-to-end anastomosis, which sometimes proves disastrous to the patient.

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DR. R. C. COFFEY, Portland, Ore.: The man who knows nothing but the drainage-tube and can use nothing else evidently does not cover the fundamental principles of drainage. The man who can use nothing but gauze and does not know when and when not to use gauze is not familiar with the fundamental principles. I think that the most exhaustive study I ever made on anything was on the matter of drainage in following the work of Clark and Yeats. They both reached the conclusion that drainage was a bad thing. They said it would not drain pus and blood, that it created a great deal of serum and was liable to infection. I admit that it forms serum in exact proportion to the amount of peritoneum that is touched by the foreign body, but the serum is brought there to form adhesions, and if we deliver it slowly by a small wick of gauze we shall produce more adhesions than if we had not touched it. On the other hand, if we drain the serum off as rapidly as it is formed we rob this area of all its adhesion-forming substance. That serum, however, is brought to the surface only in proportion to the amount of gauze that comes out through the wound. Clark used a pack of gauze folded on itself like the folds of a fan. He found large amounts of serum and adhesions after this method of drainage because it produced a large amount of serum and delivered only a small amount to the surface. If we put in enough to deliver the serum as fast as it forms, we have nothing with which to form adhesions. This is not true in the treatment of sepsis. There it is possible to operate in the most acute case with immunity. I did not have a fatality in six years when I used the method in acute pyosalpinx in which there was pus. If we deliver this serum to the surface as fast as it is formed, we keep the intestines back and have no adhesions. We do not find out by theory, but by having to reoperate in cases in which we have drained in this way. In these cases we find almost complete absence of adhesions, while, in cases drained by a simple tube or a small piece of gauze, adhesions are numerous. This, therefore, is the principle we must deal with.

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CARE OF THE UMBILICAL STUMP

A BACTERIOLOGIC STUDY

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It is not my intention to consider the clinical aspects of infections which affect the new-born infant through the umbilicus. The seriousness of such infections is well recognized. The more severe and fatal forms present clinical and post-mortem evidence which forces itself on the observer. The proof that milder types of infection originating in the umbilicus cause fever, jaundice, loss of weight and gastro-intestinal disturbances in the new-born infant is difficult to bring forward. It has been demonstrated that serious and fatal umbilical infections can exist and give no local antemortem evidence of their presence. It would not be unfair to conclude that milder forms could exist and the infant recover without local manifestations of umbilical disease. Such infections occur in isolated cases and in epidemic form in institutions. There may be the moist gangrene with the foul-smelling, putrefying cord, a simple omphalitis with a discharge of varying character, an ulcer lying between the folds of the skin at the navel, a more or less diffuse cellulitis, possibly with abscess formation. The arteries and veins may be involved with little or no local evidence of this condition. Infection of the arteries is more frequent and less serious than that of the vein which is almost invariably fatal. The septic form of umbilical hemorrhage may result from infection entering through this wound. Some of the more specific infections, such as diphtheria,

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tetanus and erysipelas may originate at this point. The much dreaded sepsis may enter and destroy the new-born babe and leave very little evidence of its entrance at this point.

In children born spontaneously, the cutting of the cord makes the only wound on its body, and this should be considered as important a wound as one which enters the peritoneal cavity. Other sources of infection must be admitted, but many of them are in no way under our control.

The care of the umbilical stump is something for which obstetricians and nurses are directly responsible. Are they fully aware of their responsibility? Certainly many of us would not care to have our peritoneal cavities opened under the same precautions which we take in severing and caring for the umbilical cord. This is especially true when we consider the great susceptibility of the new-born child to infection. Anatomically, the cord leads almost directly into the peritoneal cavity. The arteries are almost intraperitoneal and the post-natal thrombus forms an ideal place for the development of organisms. The vein, in addition to being closely associated with the peritoneum, leads directly to the liver and communicates with the large venous circulation. The lymphatics are in almost direct communication with the peritoneum. Wharton's jelly becomes virtually subserous by its extension within the abdominal wall.

The absorptive powers are great, as has been demonstrated by Epstein[1]—who used different chemicals on the cord and was able to demonstrate them in the urine within a very short time.

Clinically, there is abundant proof that fatal infections may enter through the umbilicus and rapidly overwhelm the new-born babe. Eröss[2] reported 1,000

1. Epstein: Ueber antiseptische Maasnahmen in der Hygiene des neugeborenen Kindes, Medizinische Wandervorträge, Berlin, 1888.
2. Eröss: Beobachtungen an 1,000 Neugeborenen über Nabelkrankheiten und die von ihnen ausgehende Infection des Organismus, Arch. f. Gynäk., 1891, xli, 409.

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cases, with fever in 43 per cent. and evidence of navel infection in 23 per cent. Roesing[3] in 100 cases found fever in 21 per cent. and umbilical infection in 9 per cent. Götzl in 130 cases found trouble with the navel in 13 per cent. Berend and Racz,[4] in 1,000 babies who were tubbed, found infection in 19.7 per cent., in 1,000 not bathed in only 9.3 per cent. Doctor[5] investigated a series of cases in which 420 infants were bathed, 33.15 per cent. of these had a febrile reaction and 16 per cent. showed infection of the navel. Of 462 babies with a long stump of cord, which were not bathed, there was fever in 25.83 per cent. and umbilical infection in 10.12 per cent. There was fever in 11.88 per cent. and navel infection in 3.46 per cent. of 230 infants with a short stump which were not bathed.

In 1896, Lambert[6] reported a series of 147 cases in which there were five deaths from infections originating at the umbilicus. This is a mortality of about 3.4 per cent. He was pleading for a better treatment of the umbilical cord. We all see such cases not very infrequently.

Dickinson,[7] in a most excellent and thorough consideration of this subject, collected from the literature more or less complete observations of over 10,000 newborn children. He says: "Fever due to navel infection, from 3.5 to 22 per cent., studied on 2,755 babies (the higher percentages in summer); well-defined general sepsis, 5.25 per cent., the review embracing 1,329

3. Roesing: Beobachtungen an 100 Neugeborenen über Temperaturverhältnisse und Nabelerkrankung, Ztschr. f. Geburtsh. u. Gynäk., 1894, xxx, 176.

4. Berend and Racz: Beiträge zur Frage der Nabelpflege und des Badens der Neugeborenen; Ref., Zentralbl. f. Gynäk., 1904, No. 39, p. 1173.

5. Doctor: Ueber die Heilung und Behandlung des Nabels, Arch. f. Gynäk., 1894, xlv, 539.

6. Lambert: Umbilical Sepsis in the New-Born Occurring at the Nursery and Child's Hospital, New York, during 1896, Med. News, New York, 1897, lxx, 557. Petermöller: Neue Beiträge zur Behandlung des Nabelschnurrestes der Neugeborenen, Monatschr. f. Geburtsh. u. Gynäk., 1911, xxxiv, 207.

7. Dickinson: Is a Sloughing Process at the Child's Navel Consistent with Asepsis in Childbed? Am. Jour. Obst., 1899, xl, 389.

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babies; deaths from sepsis, a full 1 per cent., the material being 6,011 new-born children. The ratio of septic deaths to early deaths from all causes varies between 15 and 40 per cent."

More recently, 795 cases treated in the Virchow-Krankenhaus by ligation and a sterile dressing smeared with oil showed inflammatory disease of the navel in 15, or 1.7 per cent.

In an endeavor to find some means of preventing these infections, I have been led to make some investigations which it is my intention to present at this time.

The first step has been to find out whether or not organisms are present on the cord and surrounding skin immediately after birth. It would be only natural to find them present.

Cholmogoroff[8] removed, with sterile scissors, pieces of the umbilical cord immediately after birth in five cases. Cultures made from these were all negative. He also investigated cases which were treated by different methods and found various staphylococci, once the streptococcus and various non-pathogenic organisms. He concluded that the cord was sterile at birth and that the germs were introduced from without.

It would be very easy for the surface of the umbilical cord and of the child's abdomen to be contaminated with any organisms present in the mother's vaginal tract or on the external genitalia. If they were on the surface, it would be very easy for them to grow and invade the tissues.

In order to prove the presence or absence of organisms on and around the cord immediately after birth, the following procedure was employed:

A platinum loop was used to scrape the cord and surrounding skin immediately after birth and before the cord was handled or manipulated in any way. Agar

8. Cholmogoroff: Die Mikroorganismen des Nabelschnurrestes, Ref., Jahrb. f. Kinderh., 1890, xxxi, 145.

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plate cultures were made from the material caught on the platinum loop. All these cultures were made under as nearly the same conditions as possible in the Elliot Memorial Hospital at the University of Minnesota. No attempt was made to isolate the anerobic organisms.

There were sixty-five cases examined in all. In seventeen of these there was no growth. Non-pathogenic organisms were found independently of any pathogens in thirty-three cases, or over 50 per cent. of those examined. Pathogenic organisms were found alone or associated with non-pathogens in twelve, or 19.46 per cent. Some variety of staphylococcus was found in eight instances and some form of the *B. coli* group in four cases.

The significance of this is evident. The cord and its surroundings show the presence of pathogenic organisms in nearly one-fifth of the cases immediately after birth. This is true where the cases are conducted amid the aseptic surroundings of a delivery room. The percentages might easily be much higher where less rigorous asepsis is carried out. This, of course, is no argument for carelessness in the subsequent handling of the cord, for it may be infected at any time.

What are the essentials for the growth of organisms? (1) the presence of the germs, (2) proper degree of temperature, (3) a suitable culture medium and environs, and (4) the presence of moisture.

It is evident that it will be very difficult to eliminate entirely the presence of bacteria, but we can avoid contaminating the parts with germs and we can assist in their removal by the use of aseptic and antiseptic measures. The body heat furnishes the proper temperature and, of course, cannot be interfered with.

The devitalized tissue of the cord forms a fine medium for the growth and development of the organisms. This can be removed by ligating or clamping the cord close to the skin margin. It has been pretty well

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demonstrated that better results are obtained by leaving as little cord as possible. Doubtless the methods of amputation proposed by Dickinson, which in his hands have given almost ideal results, accomplish this most thoroughly.

The presence of moisture may be controlled by having a small stump of cord and keeping it under conditions which favor rapid drying. Various experiments have been conducted along this line and it has been found that exposure to air is one of the best means of accomplishing this end. Hygroscopic powders have been used with some success—good results have been obtained by the use of astringent and inert powders. Equally good, or better results have been obtained without any dusting powder. Oily dressings have not given as good results. Dry occlusive dressings have been used. Gauze seems to permit of better and more rapid mummification than cotton.

In order to fulfil these conditions, the new-born babies have been treated as follows at the University of Minnesota Hospital:

After cessation of pulsation, the cords were clamped near the skin margin, the surrounding skin and cord cleansed with alcohol, and the clamp removed, to be replaced by a ligature in the groove made by the clamp. The end of the cord and the surrounding skin were painted with one-half strength tincture of iodin in some cases and in others left untreated. A sterile gauze dressing was then tied over the end of the cord. The babies were oiled for three days, then washed, but no tub baths were given until the navel was healed. Each day the stump and surrounding skin was washed with alcohol and the dressing changed when necessary.

A study of the clinical courses of these cases subsequent to delivery may be of interest and profit.

First in order is a consideration of those cases from which cultures were taken. In all there were sixty-

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five cases, one of these was a still-birth, there were three unsatisfactory cultures, which leaves sixty-one for study.

There were seventeen cases which showed no growth; of these four, or 23.5 per cent., showed a febrile reaction of over 100 F; there was one case with jaundice and the average maximum weight loss was 209 gm.

Of the thirty-two cases from which non-pathogenic organisms were recovered, there were eight, or 25 per cent., with febrile reaction; three infants were jaundiced and the average maximum loss of weight was 188 gm.

There was a temperature rise in three, or 25 per cent., of the twelve cases in which pathogenic organisms were found; one was jaundiced and the average maximum weight loss was 202 gm.

The figures are so close for the different groups that the only conclusion one could draw would be that so far as this series is concerned it made little difference whether or not the organisms were present at birth.

There was no definite evidence of any serious infection of the navel. Two were somewhat reddened without any febrile reaction, jaundice or marked loss of weight. There were two with some foul odor, one had a febrile reaction of 102 F. and a weight loss of 340 gm. The other had no reaction. Neither had any jaundice. A number of others did not heal so rapidly as usual but showed no signs of infection. None of these babies died and all left the hospital in good condition.

Fifty-eight infants were treated as outlined above with alcohol and dry dressing. Of these, fourteen, or 24.13 per cent., had a rise in temperature to 100 F. or over; eight, or 13.08 per cent., were jaundiced, and of these four had fever and there was an average maximum loss of weight of 246.2 gm. The average loss of weight in the febrile cases was 314 gm. Five, or 8.6

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per cent., had slight local evidence of navel infection, but none of them had a temperature rise to 100 F. The cord came off in five and one-half days on an average.

In the second series of cases, tincture of iodin was used to paint the cord and surrounding skin. Otherwise the treatment was the same as in the preceding series.

There were 186 babies treated in this way. The temperature rose to 100 F. or above in forty-two, or 22.58 per cent. of these; fifteen, or 8 per cent., were jaundiced, of which five had a febrile reaction. The average loss of weight was 228.05 gm. In the cases with fever, this loss amounted to 285.19 gm. Ten, or 5.37 per cent., had slight local evidence of infection of the navel, only three of which had any fever. The cord came off in seven and one-half days on an average. None of the babies in either series had any evidence of serious or fatal infection originating in the navel. How many of these febrile cases were caused by absorption of some toxic substance or the entrance of organisms through the umbilicus it is not possible to state. Many conclusions cannot be drawn from this rather small amount of material.

It is evident that some facts can be stated.

1. The cord is contaminated with pathogenic or non-pathogenic organisms at or immediately after birth in a large percentage of cases.

2. It is possible quite effectively to combat serious umbilical infections by comparatively simple methods; as shown by this report of over 200 cases with no mortality from this cause.

3. There seems to be little choice between the two methods used in these cases.

4. Jaundice in the new-born child is frequently associated with fever. It would not be illogical to sus-

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pect that this might originate by some agent introduced through the umbilical vein or lymphatics.

5. Febrile reactions are common in the new-born infant and are associated with other disturbances, such as a high primary weight loss and jaundice. They are due, no doubt, to many causes, but we, as obstetricians, should see that those due to infections entering at the umbilicus are reduced to an irreducible minimum.

For assistance in this work I am greatly indebted to the interns and nurses at the University Hospital, and especially to Prof. W. P. Larson for guidance in identifying the various organisms which were found.

ABSTRACT OF DISCUSSION

DR. CHARLES S. BACON, Chicago: I have made a practice for years of ligating the cord immediately after birth just at the juncture of the skin and cord, leaving a button simply large enough to prevent the sliding of the cord, and then dressing this with sterile cotton after first washing with alcohol. Every day I wash with alcohol and reapply sterile cotton. I have not forbidden the bath of the baby, believing that the amount of contamination in the bath-water is slight and is counteracted entirely by the immediate use of alcohol, which is the only safe antiseptic to use on the baby. With this method of treatment I have seen no serious infections and very rarely any infection at all. That there is a good deal of danger from the cord I have no doubt. I have myself seen a case of tetanus in midwife practice in which the bacillus was found around the navel. I believe that these observations can be extended to a variety of conditions, which will settle for us whether or not the bath is really accompanied with danger provided a safe antiseptic like alcohol is used immediately.

DR. N. SPROAT HEANEY, Chicago: I consider the clamp that Dr. Adair mentions a good thing since it squeezes out the moisture and allows the cord to dry out early. The earlier that the cord drops off and the wound heals the better, so the best treatment of the cord is that which best promotes this and at the same time best protects it from infection. I believe that cutting the cord long is better than cutting it short. When the cord is cut short the invagination of the umbilicus draws the stump in, and it becomes so closely approximated to the child's abdomen that it stays moist unduly long and does not drop off early. If cut longer and at the time squeezed dry, the long dry cord, wrapped in the sterile gauze abdominal band, allows the air to dry out along the

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whole extent of the cord and the cord consequently drops off earlier. This was our experience in Vienna with the short and long cutting of the cord. Cotton is especially objectionable since it is too impervious to the air. I should not want a laparotomy wound manipulated daily, and for the same reason I should not want the child's cord to be manipulated daily. I should want it made as nearly sterile as possible at the time of birth and left untouched as much as possible thereafter, having dressings changed only when wet or soiled.

DR. F. L. ADAIR, Minneapolis: In no branch of surgical work is asepsis more essential than in obstetrics, and I think further that we forget, many times, that we should carry our asepsis beyond the delivery of the mother and apply it to the baby also. In answer to Dr. Heaney, who said that the long cord drops off earlier than the short, I wish to say that this may not be desirable if we have a healthy wound covered with a scab. There is no better protection for the granulation tissue under the dry cord than a dry scab which covers it. Therefore, the statement that the long cord drops off early may not indicate a desirable condition.

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THE SERODIAGNOSIS OF PREGNANCY

HENRY SCHWARZ, M.D.
ST. LOUIS

In speaking of methods for serodiagnosis of pregnancy, I refer to the biologic tests of Abderhalden only, because the method of Rosenthal, while of considerable scientific interest, appears to be of small practical value. It is applicable during advanced pregnancy only, and all conditions associated with increased destruction of the body proteins respond to the same test.

Abderhalden's methods of serodiagnosis of pregnancy, on the other hand, give reliable information just as soon as the ovum is permanently implanted; these methods are based on specific reactions and they are suited for the widest application in the study of physiologic and pathologic conditions.

To appreciate the value and the scope of these methods it is essential to have a clear understanding of the underlying principles and to be familiar with the monumental work of Abderhalden on cell metabolism and on protective ferments, which covers a period of more than ten years of intense activity.

It appears that each body-cell, including the white and the red corpuscles and the blood-disks, carries on its own metabolism; it takes up nutritive substances from the blood, digests them with the aid of various enzymes, using the end-products of the intracellular digestion for the development of energy or linking them together into complex building-stones for the development or the repair of its own body.

The protoplasm of one group of cells differs from that of other groups of cells chemically and physically; differ-

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ence of function implies difference in structure. The protoplasm of renal epithelial cells differs in structure from the protoplasm of muscular fibers; glands with internal secretion, sending out substances which act on special cells in distant parts of the body, require special structure both in the cells whicih send out these substances and in the cells on which they act.

Such intercommunicaton of two or more sets of cells is made possible by the fact that the intervening medium, the blood, is, under normal conditions, of pretty constant composition, and that the physical and chemical conditions in the various cell-groups likewise remain fairly even.

Nutritive substances pass into the blood from two sources: namely, from the gastro-intestinal tract and from the body-cells; before entering the blood-stream they must be divested of all individual character and be reduced to the simple cleavage products which form normal constituents of the blood.

For the purpose of this paper I shall limit this review to protein metabolism.

Protein foodstuffs, no matter what their source, are conglomerations of amino-acids; these are joined together into small groups like the blocks in a Chinese puzzle; the amino group of the one acid is always joined to the carboxyl group of the other; these small groups are joined together to larger and still larger groups, until they form the large albumin-molecule.

So firmly are these amino-acids joined together, that nothing short of repeated blasting will separate the albumin molecule into its original building-stones; this blasting is accomplished by the ferments of the gastro-intestinal canal with the aid of water, which enters at the points of juncture, that is, by hydrolysis.

The work of reducing the albumin molecule to amino-acids is a gradual one; the pepsin of the stomach in the presence of hydrochloric acid breaks it up into large fragments, proteoses and peptones; the trypsin of the

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pancreas, activated on entering the intestines, reduces these large fragments into smaller ones, the peptides and amino-acids; the enzyme found in the cells of the intestinal mucosa, the erepsin, completes the reduction into amino-acids.

Substances which are absorbed from the intestinal canal must pass through the liver before they can get into the general circulation. Here they are once more closely inspected by the liver-cells and, if anything has passed that is in the least degree foreign to the blood, it is held back and reduced to a blood-own substance. The liver likewise prevents a flooding of the system with blood-own substances by holding back an excess of such substances and letting them pass on in small quantities only, or by converting them to forms which can be stored up in the body for future use.

The other source from which nutritive substances and products of metabolism enter the blood-current is from the cells of the body.

All cell protoplasm is foreign to the blood; it has been built up by the cells from the amino-acids which are blood-own and it must be reduced to its original components before it can be allowed to enter the blood.

The lymphatic system is interposed between the cells of the body and the blood-current; the leukocytes and the lymph-vessels stand guard that no blood-foreign material enter the blood through this channel; substances that are not fully reduced are held back and converted into blood-own substances before they are passed along.

By these arrangements, and with a checking system at each point of entrance, the blood remains fairly constant in composition and, under normal conditions, the plasma contains no proteolytic ferments.

Under certain conditions blood-foreign material will enter the circulation in spite of these safeguards.

Overloading the stomach with protein foods may paralyze digestion and upset the checking system of the liver; inflammation of the various organs and other pathologic

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conditions, such as germ invasion of the tissues, will cause the cells of the respective organs to pass such quantities of unreduced substances that the lymphatic system is unable to prevent their passage. Malignant and kindred cells, such as those of cancer, of sarcoma and of the syncytium, may pass sufficient quantities of blood-foreign substances to force them into the blood-current; or they may eat their way into the blood-vessels and thus enter the circulation. Bacterial invasion of the blood means the entrance of blood-foreign material in a double sense; living, the germs pass the products of their metabolism into the plasma, and dead, their bodies constitute blood-foreign protein material.

Finally, blood-foreign material may be introduced into the circulation by intravenous or subcutaneous injection.

The system responds to the entrance of the blood-foreign material by the mobilization of ferments, which appear in the plasma and reduce this foreign material to blood-own substances, which may be utilized by the cells of the body or which may be eliminated by the various organs of elimination.

These enzymes are specific in the sense that they are active only against the substances to which they owe their existence; Abderhalden has named them the protective ferments.

For instance, if fresh kidney extract is injected into an animal, the serum of that animal, taken four days afterward, will digest kidney-albumin and kidney-peptone; this digestive power is greatest if the kidneys used for the extract and for the albumin are from the same species; such serum is not active against any other tissue.

The presence of these proteolytic ferments is easily proved by the dialyzation method in the following manner: the tissue against which the serum is to be tested is boiled, so as to coagulate its albumin; a certain quantity of this albumin, together with a certain quantity of the serum, is placed in a dialyzing thimble; the thimble so charged is immersed in a vessel containing a certain

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quantity of distilled water; for control another dialyzation test is made in which the same quantity of albumin, the same quantity of serum and the same quantity of distilled water are used, but with the difference that the serum for the control has been heated so as to destroy all ferments which it may contain.

Albumins are colloid in nature and do not dialyze; as digestion progresses the albumin molecule is split into smaller and smaller fragments, which become more and more dialyzable, so that when the peptone stage is reached it is possible to demonstrate the presence of peptone in the distilled water by color reaction; the biuret reaction gives a pink color and the ninhydrin reaction gives a characteristic violet-blue color; the distilled water of the control, tested in the same way, must remain colorless.

If digestion is carried further the distilled water of the test will no longer give the biuret reaction because all peptone has been reduced to amino-acids, but it will continue to give a beautiful ninhydrin reaction.

The presence of these ferments can also be demonstrated by the optic method in which the serums are tested against peptones prepared from the respective tissues.

This method requires expensive apparatus and considerable technical training, but it contains fewer sources of error and can be applied in the study of questions for which the dialyzation method is not adapted.

My own experience with these tests is still limited to the dialyzation method, because it took considerable time to assemble the apparatus and to obtain placental peptone for the optic method, and it will take considerable more time for my associates and myself to become sufficiently familiar with the work to take it up in earnest; we expect the same large portion of trials and tribulations which we encountered in becoming acquainted with the dialyzation method.

While using the biuret reaction exclusively, I had some negative results in cases of advanced pregnancy,

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because digestion was carried too far; since using the ninhydrin reaction I have obtained positive results in some non-pregnant cases, because I worked with too large quantities of serum; at all times I have had conflicting results due to various sources of error such as bacterial growth, unclean glassware, leaky dialyzers and improperly prepared albumin; these errors and the time-consuming work of locating them I consider a most valuable experience.

On the other hand, I have the records of twenty-one pregnant and four puerperal cases, in which the test invariably has given the violet-blue ninhydrin reaction, while the control remained colorless; these cases cover the period from twelve days after the missing of the menses to the fourteenth day post partum; I also have the records of eighteen non-pregnant cases, including several tubal enlargements, four uterine fibroids and two males, in which the dialysates of both test and control remained colorless.

In all these cases I have personally done every part of the work with the exception of taking the blood from the patient, which has always been done by my associates, Drs. Newell and Royston, who are experts in securing hemoglobin-free serum.

In eight instances the serodiagnosis has been employed as the only means of differential diagnosis, and in every one of these eight cases its answers have been true. One of these was the case of a girl twelve days overdue on whom criminal abortion had been attempted, but who denied the charge and refused pelvic examination; two patients in whom tubal pregnancy was considered by the physicians in charge proved non-pregnant; the one had a pyosalpinx which was removed by operation, the other had a chronic parametritis; of two women between forty-five and fifty years of age, one, who had never been pregnant and who had menstruated regularly until eight weeks before the test was made, proved to be non-pregnant, and the other, whose youngest child was 18 years

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of age, and who likewise was four weeks overdue, proved to be pregnant; of three other patients one, with irregular bleeding without having passed the menstrual period, proved pregnant, and miscarried soon afterward; another, a young woman with irregular menstruation who had often skipped two or three months and was again eight weeks overdue, proved non-pregnant and the menses returned later; in still another in whose case there were good reasons for interrupting a possible pregnancy and who gave a positive reaction when two weeks overdue, I emptied the uterus and removed the ovum.

In all of these cases the control was carried on with inactivated serum and placenta; these tests were always made in the presence of interested physicians, and for this reason the control was extended to the examination of a case positively pregnant and to another case positively not pregnant.

The test with positively pregnant serum is desirable because we have found that one can by repeated boiling and reboiling of poorly prepared placental albumin, which has undergone autolysis, get rid of most of the albumin and obtain a placental preparation which will no longer give the ninhydrin reaction in its usual intensity.

While I am much interested in these biologic tests on account of their diagnostic value, I prize them still more highly because they open up a wonderful field for the serologic study of pregnancy, and because they may lead to a rational serotherapy of the toxemias, including eclampsia.

It has been proved that throughout pregnancy blood-foreign substances are passed from the placenta into the maternal blood-current and that the maternal system responds with the mobilization of protective ferments, which cause the intravascular digestion of this material.

Evidence is accumulating which indicates that in toxemic conditions the formation of protective ferments is deficient, and it appears rational to correct this deficiency

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by the subcutaneous or intravenous injection of normal pregnancy-serum.

440 North Newstead Avenue.

ABSTRACT OF DISCUSSION

DR. JOSEPH B. DELEE, Chicago: This subject has the broadest application and opens up a vista of possibilities which is as extensive as it is alluring. The human serum reactions interest many departments of surgery and medicine. On the injection of albumin into the blood the blood reacts with the formation of a ferment. A certain kind of albumin develops a certain kind of ferment. The highest kind of laboratory work is required for the practical development of the fine details of the subject. The asepsis of the serums must be looked after because the action of bacteria will reduce the albumin and it will then dialyze through the tube when otherwise it would not. There is difficulty, also, in getting tubes of proper dialyzing power. In diagnosis, when the question is whether a certain tumor in the pelvis is a pregnancy or something else, it is not impossible to imagine that, if it is a fibroid, manipulation will set loose an amount of albumin in the blood-stream and we will immediately get a reaction analogous to that of pregnancy serum and again, a fine differential analysis will be necessary. Ries of Chicago recently demonstrated a uterus in which a pregnancy had not occurred for eighteen years and which still had placental villi in some of the veins showing that the villi had retained their nourishment for a long period. Playfair's case proves that placental tissue can live in the uterus for eleven months. You can see at a glance how valuable a test of this kind is. From 2 to 3 c.c. of the woman's blood-serum we can tell whether she is pregnant or not. Dr. Schwarz has spoken of the importance of determining the presence of these bodies in arterial hypertension, including eclampsia. Perhaps these serum tests will clear up the question of post-partum hemorrhage. Some of these cases are due to the disorganization of the blood—the result of changes in pregnancy. The discovery opens up an immense field for study, not alone in obstetrics, but in all branches of medicine.

DR. CHESTER M. ECHOLS, Milwaukee, Wis.: I have been working on this test and have just lately gained some confidence in the results of the reaction. We all have had the experience of stumbling through several months of uncertainty, getting positive results in our control and negative results in patients known to be pregnant. In my last twenty or twenty-five cases of women known to be pregnant the results have been positive in every one and negative in the control except in a few cases where the control patients had

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other diseases. One thing gave me confidence in the test—the character of the man who devised it—Abderhalden. After three hundred consecutive positive results he still warned the profession against accepting his work at its face value, because, he said, there might be other diseases which would give a positive reaction. There are a number of fallacies which must be weeded out before we can accept this test at its final worth, but to-day no one is prepared to say the last word, although I think that it will be an exceedingly reliable test, as tests go. We know that the Widal test is not absolutely reliable. We know that there are other conditions than syphilis that will give the Wassermann reaction, and yet these two tests are valuable. To my mind, this will be the final result of our work on the Abderhalden test.

Dr. N. Sproat Heaney, Chicago: I wish that Dr. Echols had given us his experience in percentages. I did not hear Dr. Schwarz's statistics, but I gather that he has had no failures of the test. One year ago I became interested in this test. At first I worked to see if I could demonstrate an increased peptolytic power of the blood-serum in pregnancy by titration to the amino-acids, before and after incubation of the blood-serum, with peptone solution. I found that the peptolytic activity varied, and that this variation could not be brought into correlation with the gravid or non-gravid state of the patient, but that it depended on some other set of circumstances not elicited. This year we began to try Abderhalden's dialysis method of testing. We have not made a large number of tests, about twenty-eight altogether, but every few weeks we have made all the modifications of the test, as suggested by Abderhalden. The test reacted negatively twice in the presence of normal uterine pregnancy. One healthy woman who was not pregnant gave a positive reaction. We had five diseased persons who were not pregnant react positively; two males with syphilis, a woman with extensive ulceration of the rectum, a woman with tuberculous peritonitis, who had had a hysterectomy the previous year, and a woman with a fibroid uterus. Several others have not had the uniform results that Abderhalden has published and the statement that all negative results depend on defective technic does not satisfactorily explain the situation of this test among laboratory methods.

Dr. Henry Schwarz, St. Louis: In the short time given for discussion we cannot hope to settle questions of the importance of this one. All I can advise Dr. Heaney to do is to publish his cases with a detail of his technic and I have no doubt that the answer will be found. Professor Abderhalden, in the discovery of these ferments, has opened a new field and the diagnosis of pregnancy is only a trifling part of this work. I am quite sure that we should be careful

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before we talk of these questions as matters of absolute belief. We believe, but we have to prove our belief. The only way to prove this question is by publishing the detail of methods. I have no doubt that others will either convert us to their views or we shall convert them to ours.

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THE ESSENTIALS OF SANATORIUM TREATMENT OF TUBERCULOUS GRAVIDAE AND PUERPERAE AND THEIR CHILDREN

CHARLES S. BACON, M.D.
CHICAGO

There are about 32,000 tuberculous women pregnant every year in the United States. Between 44,000 and 48,000 women of child-bearing age die of tuberculosis every year. Probably one-fourth of them are puerperae or have passed through pregnancy during the year, or, in other words, the gravidae and puerperae furnish one-fourth of all deaths from tuberculosis of women of child-bearing age. From this it also follows that about one-third of the pregnant tuberculous women die within a year of their labor. Of 10,000 children under 5 years of age who die of tuberculosis every year, three-fourths are born of tuberculous mothers.

These data show a part but not all of the bearing of pregnancy on the tuberculosis problem. Besides the increased loss of life among the tuberculous due to pregnancy, there is increase of infection both among the attendants, relatives and associates of the mothers and among the children. The gravidae and puerperae constitute an important factor in keeping alive the germ of tuberculosis and preventing the eradication of the disease. This factor has not been sufficiently recognized in the past, if we consider the means hitherto employed to combat it as an index of the general appreciation of the importance of the factor.

The proper management of the tuberculous gravida and puerpera and her child is that which carries the woman through labor and the lying-in period and leaves her

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from two to four months later in as good condition as she would have been in had she not been pregnant, and presents the child at that time to its parents and to society uninfected. This means considerably more than the ordinary care received by the average obstetric patient. It means a close watch of pregnancy, conservation of the strength of the patient and timely interference if necessary. It means the most skilful conduct of labor, through which the patient passes with no unnecessary loss of blood or of strength and with no risk of infection. It means a supervision of the puerperium to prevent as far as possible the exacerbation of the disease which is so common at this time. It means the separation of the child from the mother and caring for it as long as necessary. If the child is premature or feeble, incubation may be required at first. An incidental but very important feature of the management thus outlined is the education of the mother and her relatives.

We are of course considering only cases in which there is no therapeutic interruption of pregnancy. Possibly in 10 per cent. of all pregnancies in tuberculous women, or in 3,000 a year in the United States, therapeutic abortion is indicated. In the very great majority of cases, however, we must face the problem of a proper conduct of these patients through labor and the puerperium.

The obstetric management above outlined can be carried out in a private house only with considerable difficulty. It requires in the obstetrician peculiar skill, training and patient persistence. It demands likewise similar qualifications in the nurse. It is possible only among well-to-do patients who are sufficiently intelligent to agree to the regimen required. Probably not more than 10 per cent. of the 32,000 tuberculous gravidae found yearly in the United States could be ideally managed in their homes.

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The labor can be conducted better in a maternity hospital or in the maternity department of a general hospital than in the home, but the conduct of the latter part of pregnancy and a long puerperium, which are at least as important as the conduct of labor, cannot be provided in such a hospital. Moreover, hospitals hesitate to admit patients infected with tuberculosis.

Hence comes the necessity for a maternity department in the tuberculosis sanatorium. We believe that three-fourths or even nine-tenths of all tuberculous gravidae should be cared for in such sanatoriums, and we insist that such care is necessary for at least one-third of these patients in order to protect them and society. This would mean that in the United States about 10,000 tuberculous gravidae should be sent to sanatoriums. To show the need of institutional treatment of the poor it might be stated that about eighty to one hundred pregnant women are included in the 8,500 patients who last year applied to the dispensary department of the Chicago Municipal Tuberculosis Sanatorium. All of these pregnant women should be cared for during the latter part of pregnancy and for some time after labor in a sanatorium.

Up to the present time there has been no provision made for these patients either in this country or in Europe. On the contrary, all institutions have practically excluded pregnant women. In the United States among the 30,000 to 40,000 hospital beds for consumptives not one is available.

This situation is probably due in part to the fact that hitherto this feature of the tuberculosis problem has not been emphasized, and in part to the supposed difficulty of providing a maternity department in connection with a general tuberculosis sanatorium. It is especially the object of this paper to call attention to the ease with which such a department could be provided. The essentials of sanatorium treatment are few and simple and not expensive. They can be provided in any large

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institution with little trouble and cost. Every state or municipal institution should certainly supply them, for the patients coming to these institutions are especially in need of sanatorium care. Many of these patients already have one or more small children. This is one of the great difficulties in securing proper sanatorium care for them. The mother cannot and will not leave her little children at home or elsewhere to the care of relatives or friends. Careful examination will show usually that the children are already infected. Any adequate solution of the problem must provide for these children.

The Chicago Municipal Tuberculosis Sanatorium which is now under construction has provided an obstetric department that may be taken as an illustration of what can be accomplished without making any material change in the plans of the institution. This institution is located in the outskirts of the city on a half section of land and will provide for 850 patients. Through the center of the grounds extend the four main buildings, the administration building, dining rooms, the infirmary and the power-plant. On each side are located about twenty open-air cottages, those for the women being on the right hand or south side. The infirmary is a two-story building built in an H-shape, the south side being used for the women. In the infirmary are housed the patients that are unable to be around. In this infirmary is located the nursery and confinement room of the maternity department, as well as the rooms for small children.

Before describing the arrangement further let us consider what is needed in the maternity department of a tuberculosis sanatorium. Five things will be required: (1) provision for gravidae; (2) a confinement room; (3) provision for puerperae; (4) a nursery; (5) a children's department.

Both gravidae and puerperae can be housed in the cottages or in the infirmary. If the pregnant women are able to walk around they can remain in a cottage

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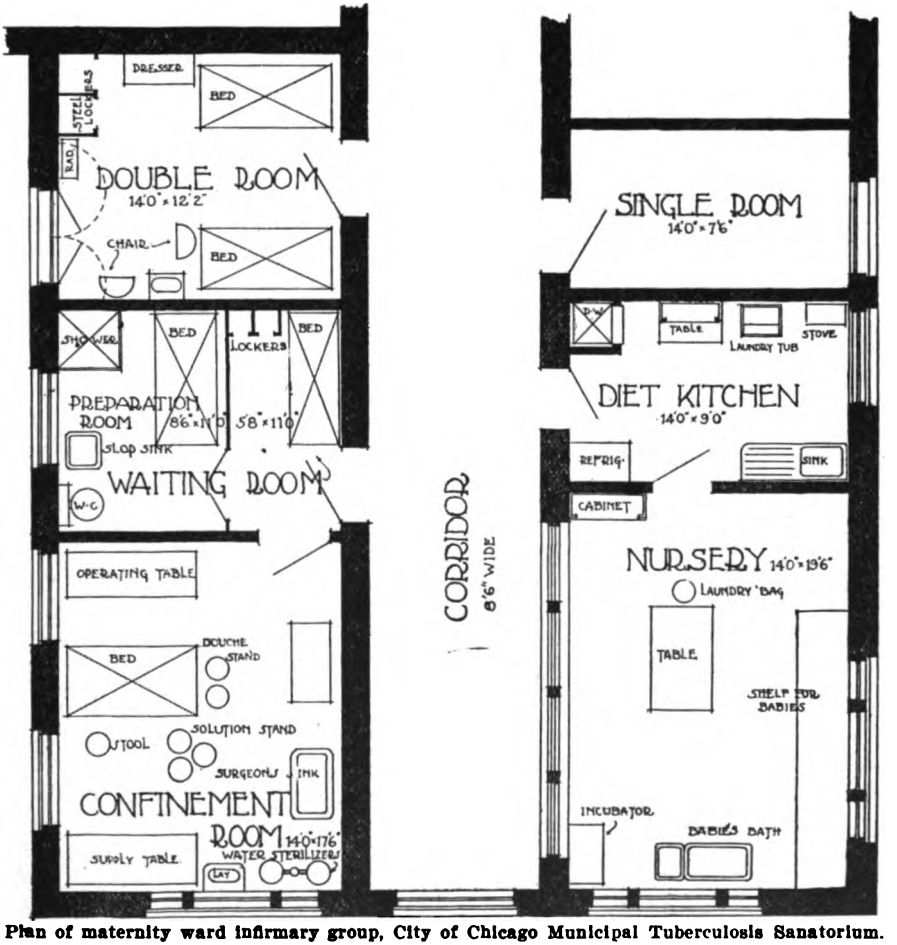
near to the infirmary. The only especial provision required is, perhaps, that they be provided with an exercise place that is somewhat secluded, and this can be done by fencing off a section of the grounds with shrubbery. As soon as a puerpera is able to be around she may also go to a cottage.



Plan of maternity ward infirmary group, City of Chicago Municipal Tuberculosis Sanatorium.

The confinement and preparation rooms are like similar rooms in any hospital and are necessarily located in the infirmary.

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The children's department, where the small children of the gravidae will be kept, is on the second floor of the infirmary above the obstetric department. There are rooms, wards and sun parlors in the porches so planned that the more serious cases can be separated from the light or doubtful infections.

The essential feature of the plan is the nursery. This should be on the sunny side of the building and should be well heated and ventilated. It should be separate from the mothers but located near them. It should provide at least 16 square feet of floor space, or 160 cubic feet of space, for each baby.

A study of the plan will show how these features are provided in the nursery of the Chicago institution. Two rooms, a nursery 14 by 20 feet and a nursery diet-room 14 by 9 feet, are located in the southwest corner of the women's part of the infirmary. To separate the babies from the mothers and yet keep them contented is the difficult problem. This is accomplished by having a glass partition between the corridor and the nursery so that the mothers can see their babies during the bathing or at any time.

The heating plant will furnish the nursery any degree of heat required. An incubator will be installed for premature or especially feeble babies.

In feeding the babies it is planned to utilize the mother's milk as much as possible. Inoculation and other bacteriologic tests of the milk will be made to determine whether the milk from a mother is free from tuberculosis germs or not. In case it is safe, and if the condition of the mother allows lactation, her milk will be obtained by hand milking or with a pump. This milk will be preserved in the diet room and fed to the child, supplemented by such artificial feeding as may be required.

This nursery will hold about eighteen babies, allowing each over 16 square feet of floor space and 176 cubic feet of space. Mothers and babies should be kept three

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months, and this would give a capacity of about seventy-two patients a year. If the mothers can be induced to remain only two months, as will probably be the case, the capacity of the nursery will be 108 a year. The capacity for gravidae and puerperae is unlimited, because any of the beds of the institution can be used by them. It is predicted that the applications for the first year or two will be about 100, or about one-eighth of the tuberculous gravidae of Chicago. Later, if the number increases, the nursery can be enlarged by using the adjoining rooms on the other side of the diet room.

Eventually it may be desirable to erect a separate building for the maternity cases. The space provided in this pioneer plan, and also the equipment, is the minimum. Of course it is not pretended that an ideal nursery is provided. It is claimed that for the cost it is sufficient and eminently practical.

The accouchement room, with the adjacent preparation room and waiting-room, can be used not only for confinements, but also for induction of abortion when this operation is indicated. Other clean obstetric or surgical operations might also be made in this room in order to utilize it to its fullest extent.

In the hygienic and dietetic management of the pregnancy and the puerperium the same principles apply as in the management of any other tuberculous patient. Rest, massage, respiratory and general exercises, recreation, sleep, feeding, control of excretions, all must be attended to. Good scales are an essential part of the equipment to enable us to control the progress of the cure and determine the effect of lactation in the puerperae. Of course the general laboratory of the institution will furnish the necessary laboratory examinations.

This preliminary announcement of the plans of the maternity department of the Chicago Municipal Tuberculosis Sanatorium is permitted by the trustees of the institution, all of whom have shown much interest in this

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new department. They have been prepared under the special direction of the president, Dr. Theodore B. Sachs, and of the architect, Mr. Otis.

This outline of the sanatorium management of tuberculous mothers and their children is given as a contribution to the solution of the problem, and to invite interest in it and stimulate discussion of the principles and details of the plan. Later we hope to be able to describe its workings and compare them with those of other institutions which may be incited to undertake similar work.

2156 Sedgwick Street.

ABSTRACT OF DISCUSSION

DR. WALTER J. MARCLEY, Minneapolis: We have here the possibility of the control of the tuberculous mother, the proper care of her lying-in period, prevention of tuberculosis in the young child, the sanatorium treatment of children from the home already infected and the education of the mother who will go back to her home. We know that it is more and more necessary to work with the children already infected. The details of the plan are to be worked out. Whether the child shall be fed on the milk of the tuberculous mother, whether the mother will be content to look through a glass window at her child, whether the mother would go into an institution and whether she would stay, are all details of the plan to be settled from the social point of view.

DR. MARY STRONG, Omaha: We do not believe in feeding babies on the milk of a tuberculous cow, why then should we ever feed a baby on the milk of a tuberculous woman? It seems to me that the latter is worse.

DR. CHARLES S. BACON, Chicago: I suppose it is known that the milk of the tuberculous cow becomes contaminated with the tubercle bacilli from the intestinal tract unless there is some tuberculous sore of the udder. It is possible that there may be infiltration of the germs through healthy milk-glands, but probably this is rare. This is a problem to be worked out and this as I have said can be done only by careful examinations, inoculations and other experiments.

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THE VALUE OF ABDOMINAL MEASUREMENTS IN PREGNANCY

A STATISTICAL STUDY

ALFRED BAKER SPALDING, M.D.
Professor Obstetrics and Gynecology, Stanford University Medical Department
SAN FRANCISCO

Since 1904 it has been customary for the assistants and students in my clinic at the San Francisco Maternity to measure the height of the fundus uteri above the symphysis in all cases of pregnancy. Measurements have been made with a tape-measure, placing one end on the upper border of the symphysis and the other on the ensiform cartilage. The uppermost margin of fundus of the uterus is located and read off the tape. In this paper, an effort will be made to estimate the value of these measurements in so far as they relate to the size of the unborn child and to the probable date for delivery.

Some years ago Ahlfeld[1] measured with a pelvimeter, the height of the fundus uteri in a series of cases and concluded that from the twenty-fourth to the fortieth week the height of the fundus increased gradually from 15 cm. to 26.1 cm. He also made the valuable observation that while with the same measurement the weight of the babies varied, the length was very constant and was always twice the inter-uterine axis. But he did not associate these measurements with any rule for estimating the probable date for delivery.

1. Ahlfeld, F.: Bestimmungen der Grösse und des Alters der Frucht vor der Geburt, Arch. f. Gynäk., bd. ii, 353, 1871.

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Ahlfeld's work has been verified by Tramer,[2] Walraf,[3] Suttigen[4] and many others, but of late years so much attention has been given to estimating the size of the fetal head *in utero* by means of Muller's method of impression, or Stone's[5] modification of Perret's[6] method, that Ahlfeld's work has been neglected.

Suttigen[4] condemned the use of a tape-measure in measuring the fundus and stated very truly that the variations with a tape measure extended from 2 to as much as 13.5 cm. while with a pelvimeter, the variations were only from 2 to 5 cm. He observed that one of the chief causes for this variation was the contractions of the uterus. As the uterine contraction continues, the fundus rises higher and higher to subside at the end of the contraction to the original measurement. This is a very practical point and should always be taken into account in drawing conclusions from fundus measurements.

McDonald,[7] a few years ago, published a rule for estimating the period of pregnancy by measuring with a tape measure in a somewhat similar method to that which is described in the present paper but, unfortunately, his paper lacks statistical presentation and has overlooked the important point that as pregnancy advances the rate of uterine enlargement lessens. His rule is to divide the height of the fundus in centimeters by three and one-half in order to obtain the lunar month of pregnancy. About the same time I published a somewhat similar rule based on clinical observations, but also

2. Tramer, D.: Ueber die Bestimmung der Grösse des Kindes vor der Geburt, Bern, 1881.
3. Walraf, J.: Ueber Lingemessung der Frucht während des Geburtsactes, Berlin, 1873.
4. Suttigen, V.: The Means of Ascertaining the Length of Gestation by Measurements of the Fetus and Gravid Uterus during the Second Period of Pregnancy, Obst. Jour. Great Britain, London, 1875-76, iii, 397.
5. Stone, W. S.: Antepartum Measurements of the Fetal Head. Med. Rec., New York, Nov. 4, 1905, p. 725.
6. Perret: Bull. Soc. d'obst. de Paris, 1898, p. 58.
7. McDonald, E.: Mensuration of the Child in the Uterus with New Methods, THE JOURNAL A. M. A., Dec. 15, 1906, p. 1979; The Duration of Pregnancy with a New Rule for its Estimation, Am. Jour. Med. Sc., September, 1910.

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Consequently, it is with many misgivings that the present statistical paper to estimate the value of uterine measurements is presented. Over two thousand records of confinement have been reviewed. On Chart 1 will be found the weights of babies taken immediately after delivery in a series of 300 labors where the height of the fundus and the degree of settling, or in other words, the total uterine axis was carefully observed. It will be noted that 157, or over half of the series, give fundus measurements between 34 and 37 cm. with average weights for the babies, between 3,275 and 3,395 gm. This might be considered a rough standard for average normal babies. Eighty-eight give fundus measurements between 38 and 45 cm., with average weights for the babies between 3,555 and 4,100 gm., besides five cases of twin delivery. This is a rough standard for over-maturity of the child. Fifty-five fundus measurements averaged betwen 2,125 and 2,930 gm. This also could roughly be stated as a standard of imperfectly matured babies. With experience, one can utilize these measurements to advantage in certain cases of toxemia, nephritis, heart-disease, etc., to determine the best period for the induction of premature labor or of the advisability of inducing labor at term; but unfortunately the possibility of error in exceptional cases precludes the utilization of these measurements in the management of contracted pelvis. It will be seen on the chart that with the same abdominal measurement, there is a variation in the weight of the child in exceptional cases of as much as 1 or 2 kilos. A great deal depends on the care with which the measurements are made, on the condition of contraction or relaxation of the uterus, on the skill of estimating the degree of settling and on the thickness of the abdominal walls, as well as the accuracy in diagnosing such conditions as hydramnios and multiple pregnancy.

Chart 2 presents the measurements of the uterus made at various weeks of pregnancy in a series of 411 patients. The patients in this series knew the date of

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their last menstrual period, gave birth to normal-weight babies within seven days of the expected time according to Naegle's rule and were not complicated with hydramnios or multiple pregnancy. The measurements begin with the twenty-fourth week of pregnancy and extend to the forty-first week. For each week the number of patients measured, which vary from five to forty-two, is stated on the charts. The upper and lower curves represent the greatest and the least measurements while the middle curve represents the average measurement obtained each week. The variations are the same that Suttigen noted and are due not only to personal equation, but to contractions in the uterus caused by manipulation of the fundus. I have tested this in personal cases and find that with a single examination these errors of variation are always possible, but with care and with repeated examinations at intervals, averages according to the middle curve are very constant.

Comparing these curves with the results obtained by Ahlfeld[1] and Suttigen[4] in a similar series of cases measured with a pelvimeter, it will be noticed that, even though the error of variation is less when measurements are made with a pelvimeter, the rate of increase noted from week to week is so small that no practical rule for estimating the period of pregnancy could be devised. In other words, measuring with a tape measure magnifies the results obtained with a pelvimeter (not only the errors but the averages as well) and permits of utilizing these measurements in a practical way.

In studying the curve of the averages, it will be noticed that there is a gradual increase in the height of the fundus from the twenty-fourth to the thirty-sixth week; after that, an irregular increase to the thirty-ninth week, and then a sudden drop to the forty-first week. The irregularity after the thirty-sixth week can be accounted for in the settling, which also causes some of the errors of variation noted throughout by the upper and lower curves.

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Comparing the known week of pregnancy with the average measurements of the height of the fundus, it will be noted that between the twenty-fourth and twenty-eighth week or during the seventh month, the fundus measures 2 cm. less than the week of pregnancy; between the twenty-ninth and thirty-third week, or roughly the

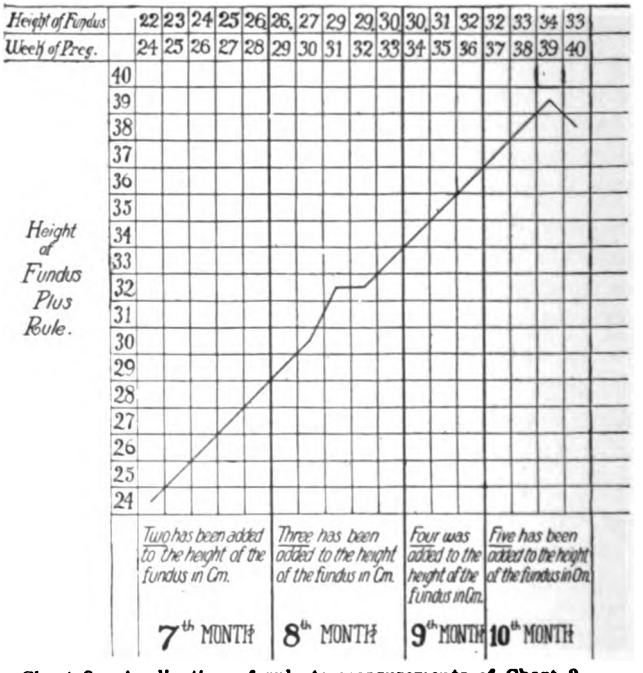
Height of Fundus
Week of Preg.
22 23 24 25 26 26 27 29 29 30 30 31 32 32 33 34 33
24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
40 39 38 37 36 35 34 33 32 31 30 29 28 27 26 25 24
Height of Fundus Plus Rule.
Two has been added to the height of the fundus in Cm.
Three has been added to the height of the fundus in Cm.
Four was added to the height of the fundus in Cm.
Five has been added to the height of the fundus in Cm.
7th MONTH
8th MONTH
9th MONTH
10th MONTH

Chart 3.—Application of rule to measurements of Chart 2.

eighth month, the fundus measures 3 cm. less than the week of pregnancy; between the thirty-fourth and thirty-sixth week, or in the ninth month of pregnancy, the fundus measures 4 cm. less than the week of pregnancy; and after the thirty-sixth week, or in the last month of pregnancy, the fundus measures 5 cm. less than the week of pregnancy.

Transposing these figures, it is easy to compute a rule for estimating an unknown week of pregnancy from the measurements of the height of the fundus. This has

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been done and has been found of considerable value, particularly in clinic patients, in whom so often no menstrual history can be obtained. The rule is: Measure with a tape measure the height of the fundus above the symphysis in centimeters, making allowance for settling when present, and add two to measurements between 22 and 26 cm., three to measurements between 26 and 30, four to measurements between 30 and 32 and five to measurements over 32, which sum will equal the probable week of pregnancy.

In Chart 3 the rule just stated has been applied to the measurements shown in Chart 2. It will be noted that with one exception, the estimated week of pregnancy corresponds exactly with the known week of pregnancy to the thirty-ninth week. It will be found that, with care, it is possible, as illustrated in this paper, to estimate accurately the probable week of pregnancy from the fundus measurements and in about three-fourths of all cases to estimate as closely as with Naegle's rule the date for the probable delivery.

CONCLUSIONS

Abdominal measurements are of value in estimating the degree of maturity of the unborn child. It is possible to estimate with considerable accuracy the probable week of pregnancy from accurate measurements taken with a tape measure of the height of the fundus above the symphysis.

Lane Hospital.

ABSTRACT OF DISCUSSION

DR. FREDERICK E. LEAVITT, St. Paul, Minn.: I have never accustomed myself to the use of the tape measure in the estimation of the size of the abdomen. I have depended rather on my own judgment and the estimate made from the manual examination. Dr. Spalding stated that in three-fourths of the cases it was possible in this way to estimate the date of labor correctly. From my own experience I think that I could strike it a little closer than that by estimating the probable date of labor from the date of the last menstruation. I do not see that there is any particular advantage in these

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abdominal measurements when we have accurate dates as to the last menstruation or the probable time of fertilization. The thing which interests me in abdominal measurements is to find out the proportions. The fetus is largely an unknown quantity, and in considering whether a patient is going to have a difficult or easy labor it is desirable to know how large the fetus is and whether or not it is out of proportion to the size of the mother. If the measurements indicated will help us, the idea is an advantage and of more importance than estimating the probable time of labor from dates. I have in mind several instances in which measurements of this kind would not have been of much value. In a family of two or three sisters and nieces there is a tendency to deliver short of full-term pregnancies. Some have gone thirty-four weeks, quite a number thirty-six, but none the full forty weeks. In these cases the measurements would not have helped to decide the date of labor.

DR. E. GUSTAV ZINKE, Cincinnati: A good obstetrician always regrets to accept a case of labor at, or just before, labor has begun. Some of the questions to be determined beforehand are: Is the patient pregnant? If pregnant, can she give birth to a child at full term? If so, what is the position of the child *in utero*? What is the general health and condition of the patient? And many other questions of great importance. Unfortunately, there are many who practice obstetrics who do not take the necessary care. It is this negligence which frequently gets both practitioner and patient into trouble. There is really no excuse on the part of the obstetrician, who is "engaged" long before labor, not to know the case before him and whether or not he will have a stormy time. Are the kidneys doing their duty? Are the emunctories of the body in perfect order? These queries bear significantly on the course and treatment of pregnancy and of labor. He who studies his cases carefully will not be taken by surprise.

DR. A. B. SPALDING, San Francisco: I think that we all realize how often women do not know the time of their last menstruation. I have seen a great number of charts which state that the labor is two months past the expected date for delivery. Again, when treating patients of a higher class — and the two classes that receive good service are the very poor and the rich — it will often be noticed that the pregnancy has run over the expected time for delivery. When pregnancy runs over, we should measure the height of the fundus as well as the pelvis. These measurements are of particular value in the class of patients who rest and eat too much. We have at our disposal good methods for the induction of labor at any time we desire, and that time should be when we think the child is large enough to survive and small enough to do the least injury to the mother's genital organs. In patients with habitual short-term pregnancies, we can

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measure the baby *in utero* and if we find that it is too small we can overfeed the mother and get it up to a normal weight. The operation for preventing prolapse of the uterus is of great interest to all of us. One of the best methods to prevent prolapse is to measure the abdomen every two or four weeks during the latter weeks of pregnancy, in order to know when the baby is fully developed and, at the same time, not so large as to cause serious injury to the woman's organs during labor, which will require subsequent serious surgical work or, more often, years of misery for the woman. It is the shame of obstetricians that so many of these cases go to the gynecologist afterward. There is no reason to my mind why patients should leave the hands of the obstetrician with damaged or diseased abdominal or genital organs if he does his work completely and properly. That is why I have presented this simple obstetrical paper. It is in the hope of encouraging enthusiasm for prophylactic gynecologic work rather than enthusiasm for repair work on women after years of misery due to poor obstetrics.

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EXPERIMENTAL TRANSPLANTATION OF INTESTINE AFTER EXTENSIVE EXCISION OF THE SIGMOID

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RICHMOND, VA.

This subject was suggested to me by a case that came under my care about five years ago. The patient was a colored man, a deaf mute, who had been suffering from obstruction of the bowels for several days before admission to the hospital. He was enormously distended and his condition was desperate. Operation was done under cocain and a volvulus of the sigmoid found. The sigmoid was twisted and so distended that it resembled a large cyst. The volvulus was excised and after removing the diseased bowel it was impossible to approximate the lower end of the large intestine to the small portion of the descending colon that was left. An artificial anus was formed. The patient recovered and left the hospital about four weeks after the operation. He was very ignorant and could not properly take care of himself. His condition was pitiful in the extreme.

The necessity for excision of the sigmoid occurs not infrequently. Sometimes it should be so extensive that the ends of the bowel cannot be united. The chief conditions that render this necessary are volvulus, ulcers, or malignant tumors. The sigmoid may be secondarily involved by growths of the ovary or uterus so that its excision is necessary either from extension of the growth or from interference with the nutrition of the sigmoid. Sometimes it is so entangled in inflammatory products, or affected by benign ulcers, tuberculous or dysenteric,

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that extensive excision is advisable. In a few cases of dysentery in which absolute rest is indicated for the ascending and transverse colon and excision demanded for the sigmoid, an operation which would accomplish this and at the same time do away with the necessity of an artificial anus would be desirable.

Bearing these points in mind, I have been working experimentally on the problem. All the experiments have been done on dogs and the operations have been performed under full ether anesthesia. Every precaution was taken to prevent pain and suffering to the animal, and no more experiments were done than seemed necessary to prove the point in question.

In the first experiment, part of the sigmoid was excised and a section of the ileum four and a half inches long was transplanted. According to some previous experiments[1] it seems proved that if as much as 4½ inches of the small intestine be devascularized entirely and the omentum wrapped around it, nutrition will be maintained. So this amount of the ileum was removed and transplanted where a portion of the sigmoid had been excised. The segment was surrounded by omentum which was held in position by a few silk sutures. The dog died in twenty-four hours, and postmortem showed that the transplanted segment was completely gangrenous. The technic was then varied so that about four inches of the ileum was resected leaving its mesentery attached. The ileum was reunited and its resected portion transplanted to take the place of the excised sigmoid. After the suturing was done, the mesentery of the transplanted section of the ileum was cut and the segment surrounded by omentum. The dog lived nine days. Postmortem showed that while most of the transplanted bowel had lived there were perforations in several places and general peritonitis. The ileum was next transplanted in the manner just

1. Horsley, J. S.: The Journal A. M. A., Aug. 12, 1912, p. 597; and Ann. Surg., April, 1913.

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indicated except that its attached mesentery was left intact. About 2 inches of ileum were transplanted. This dog died in four days and the condition of the intestine was quite similar to that found in the second experiment.

From these experiments it seemed that the transplantation of a segment of small intestine to take the place of a defect in the sigmoid was not satisfactory because the ileum, being smaller in diameter than the sigmoid and not prepared to resist the impact of the hard, dry, fecal masses gave way under the new conditions, ulcerted and perforated. In order to overcome this, it would be necessary to deliver the fluid fecal contents directly into the distal end of the excised sigmoid. This was accomplished in nine experiments in the following manner: The ileum was cut across at the ileocecal valve and transplanted into the distal end left after excising the sigmoid. The end of the descending colon, or upper stump from the excised sigmoid, was then drained by a lateral anastomosis into the ileum. (Fig. 1.) The advantages of this operation are apparent. The fluid fecal contents are delivered directly into the lower stump of the sigmoid without any undue friction on the transplanted ileum. The remaining portion of the large bowel has its secretions drained into the ileum and at the same time acts as a reservoir. If the fecal current is delivered too rapidly, the bowel can hold some excess feces and so prevent the chronic diarrhea which is frequent and often serious after total excision of the large bowel. Excision of the cecum, ascending and transverse colon, or the necessity for draining them by an external opening is obviated by this operation. The procedure is comparatively simple—merely cutting across the ileum, transplanting it to the sigmoid end-to-end and then a lateral anastomosis of the end of the large bowel to the ileum higher up. This can be done quickly when compared with such prolonged operations as total excision of the large bowel, is less dangerous, and, on the other

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hand, does not require an artificial anus, or any secondary operation as would be the case if the large bowel were drained externally.

Of the nine dogs operated on, six survived and were killed by chloroform, 84, 68, 48, 50, 47 and 54 days, respectively, after the operation. The openings were satisfactory and the intestine was well nourished in each case. Adhesions were always present though there was no evidence of obstruction. In one specimen there was a small abscess near the stump of the descending colon; this stump had been simply ligated without invagina-

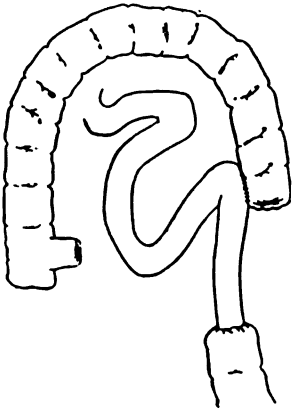

Fig. 1.—The sigmoid has been resected. The upper stump has been closed by invagination, the ileum cut across near the ileocecal valve, and its distal end closed by invagination. The ileum has been sutured to the distal portion of the sigmoid end-to-end and the descending colon is drained into the ileum by a lateral anastomosis. In this way, the defect left by excising the sigmoid is bridged over by transplanting the ileum, and the secretions from the large bowel are drained into the ileum.

tion. In two dogs of the series, the bowel ends were sutured and invaginated as described below; both the specimens were satisfactory though there were some adhesions. Of the three deaths, one occurred from perforation of the ileum just opposite the site of the lateral anastomosis by a large piece of bone sixty-one days after operation. The bone was jagged and caught in the lateral opening and was held

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firmly, a sharp spicule perforating the ileum. Both of the other fatal cases were due to leakage at the stump where simple ligature without invagination was used. One dog did not die till forty-three days after operation. An abscess had probably formed at the stump of the colon and been localized for some time before rupturing. Post-mortem showed leakage at the stump of the colon with general suppurative peritonitis. The third dog died two days after operation. Post-mortem showed leakage at the stumps of colon and ileum, and peritonitis.

The steps of the operation in order are: excision of the sigmoid, closure of its proximal stump, division of the ileum about 2 inches from the ileocecal valve, closure of its distal stump, union of the ileum to the lower end of the sigmoid, and lateral anastomosis between the ileum and descending or transverse colon. The details of these steps are important and will be discussed fully. Let us first consider the technic of closing the bowel ends. This is done at the end of the descending colon and at the distal stump of the ileum. I first tried Lilienthal's method of simply ligating firmly the bowel ends just as in ligating the pedicle of a tumor. This is quick and simple and works nicely in appendectomy. In the experiments, it was found that two of the seven dogs in which the ends were merely ligated, died from leakage at the stump of either the ileum or colon. This seems due to the fact that although the ligatures may be tied tightly the muscular coat is so thick and heavy the ligature gradually cuts and becomes loose. The powerful peristalsis of the dog's bowel also tends to loosen the ligature. In the dog a simple ligature of the bowel end is unsafe. The method of closing the bowel ends that was found satisfactory was to place a stout overhand suture in the margins of bowel ends, going through both walls at the same time. No deeper bite should be taken than is necessary for a secure hold and the stitches should not be too close together. The ends

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of the suture are then tied tightly together, making only one knot. The ends of the suture may be caught with a hemostat and used to steady the bowel while inserting a purse-string suture, or the purse-string may be placed at what is thought to be the proper place before the bowel is divided. The purse-string suture should be placed not more than half an inch from the end of the bowel, for if placed farther away invagination is more difficult. After invagination of the bowel ends and tying the purse-string suture, the next step is the union of the ileum to the lower end of the sigmoid.

Because of the short end of the sigmoid that would be left after a wide excision, the union here is best done end-to-end, and not laterally. As fluid feces will be delivered by the ileum directly at the point of union, there seems no reason why the end-to-end union should not be made as in the small bowel, though for additional safety in man a rubber tube might be placed from the anus to the point of union and fastened in place for a few days by a catgut suture. The method of end-to-end union that has proved satisfactory in all these cases is one that I have been using for more than eight years. Before the bowel is divided, the mesentery is cut close to the bowel wall, and the triangular area where the mesentery separates is grasped with a hemostat and ligated with silk or linen (Fig. 2.) The objection chiefly urged against end-to-end union of bowel is that healing is difficult at the mesentery border and the cause of non-union is ascribed to lack of peritoneum. This may be true, but it is probable that infection of this area is also the cause of many failures. It is the usual practice to divide the bowel from the free border to the mesenteric border and the knife or scissors that cuts the septic mucosa also cuts through this triangular area, which is areolar tissue rich in blood-vessels and lymphatics. After this area is inoculated in this manner, it is the usual practice to close it, thereby sealing in bacteria that are likely to cause infection and non-

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union later at this point. By adopting the step mentioned above, this area is covered with peritoneum and, what is more important, its blood-vessels and lymphatics are closed before the septic bowel is opened. The bowel is then divided and its ends cleaned with moist antiseptic gauze. The first stitch begins in the end of the bowel at the operator's right-hand, about one-third of an inch from the mesenteric border. It is a mattress stitch and starts from the mucosa of the right bowel penetrating all coats. Then the needle is carried across to the left end of the bowel and penetrates all coats, entering on the peritoneal surface and emerging from the mucosa. It comes back in the reverse direction, entering the mucosa of the left bowel end and emerging on the peritoneal surface, then enters the peritoneal surface of the right bowel emerging from the mucosa. The thread is tied leaving an end about four inches long which is clamped with a light hemostatic forceps. The needle is then passed back and forth through all coats of the bowel, suturing away from the operator, making a continuous mattress stitch. Care must be taken to include a portion of the mesentery that has been tied, else it will slip back and will not be included in the suture. Each suture here must be very snugly approximated. After about one-third of the circumference of the bowel has been sutured, the needle emerges from the lumen of the right end of the bowel, and is thrust through all walls of the right end, appearing on the peritoneal surface (Fig. 3). The stitch is continued as a right-angle stitch penetrating all coats (Fig. 4). Snug approximation should be made with each stitch and at about every fourth stitch a back-stitch should be taken in order to prevent the thread from drawing too tightly and so diminishing unduly the caliber of the bowel. This is done by taking two stitches on the same side, the last one being slightly farther back than the preceding stitch. In this manner it is impossible to draw the thread too tightly. It is very important to

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have the first third of the suture line that unites the mesenteric border drawn tightly, but after this unless the back-stitch is taken at intervals, pulling the thread may diminish the lumen so much as to produce obstruction.

The suture is continued toward the operator and is carried a short distance, about a stitch, beyond the lowest point where the original thread left when the knot was tied comes out. This last stitch should be taken in the left-hand side of the bowel. The thread is then tied firmly to the original end that is grasped in the hemostat. The knot should be tied parallel to the line of suturing so as to sink in easily and should be tied quite snugly. If a back-stitch has been taken at proper intervals, there is no danger of reducing the lumen by tying this knot too tightly. It had best be tied three times and then cut short; the ends will disappear within the bowel.

This method is simple, leaves all knots within the bowel, and I have never seen a leakage from it when it was properly used. The danger of obstruction to the lumen is obviated by putting in occasional back-stitches and by properly approximating each stitch as it is made. The thread is all practically buried, leaving almost no thread exposed on the peritoneal surface, and the whole suturing can be done very quickly. All of these features are important and particularly so after a rather extensive operation such as transplantation of the bowel after resection of the sigmoid.

The next step to be considered is the draining of the large bowel. This is best done by a lateral anastomosis between the end of the descending colon and the ileum at such a point above its junction with the lower portion of the sigmoid as to provide against any undue tension. The lateral anastomosis can be used according to the technic of a gastro-enterostomy. A rubber-covered clamp is placed across the colon about four inches above its stump and another similar clamp grasps the

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ileum laterally. The union is made as close to the end of the colon as possible. After thoroughly packing off the surrounding structures, one stitch of silk or linen is taken at the upper portion of the proposed lines of incision into the intestines and the suture tied and left long. This fixes the ileum and colon together. An incision is then made into each and the bowel cleaned out with moist, antiseptic gauze. The bleeding points, if spurting, are clamped and tied taking a small bite of tissue. The bowel is united by a continuation of the first stitch which is applied quite snugly and each stitch locked as in the button-hole stitch. When the lower end of the incision is reached, the suture is converted into right-angled stitch penetrating all coats, and about every other stitch is locked after the manner of the button-hole stitch. The end is then tied to the original end which was left long and grasped with the forceps.

This suture has always been satisfactory, it is practically buried throughout its course, and it saves an apparently unnecessary second suture. It is done with a curved needle. One row seems all that is necessary here and makes less flattening of the bowel. If the operator prefers, however, there is no serious objection to following the identical technic of a gastro-enterostomy and using two rows of sutures.

ABSTRACT OF DISCUSSION

DR. C. E. RUTH, Des Moines, Iowa: The function of the large intestine is to absorb a large portion of the solid matter. To overcome the difficulty which may be caused by the small intestine carrying the fecal current of the colon it may be necessary to make the anastomosis in the side of the colon. In intestinal anastomosis one point of danger is due to the divergence of the mesentery, and the next point of greatest weakness is that most distant, because of the lessened blood-supply. Another thing that should be kept in mind is that in the union of these two points with an angulation like that when the end-to-end anastomosis is made, there is not the slightest risk of contraction of the lumen of the intestine, but you can make the angle greater. The tendency is to a lesser degree of caliber rather than to a greater when an end-to-end anastomosis is made.

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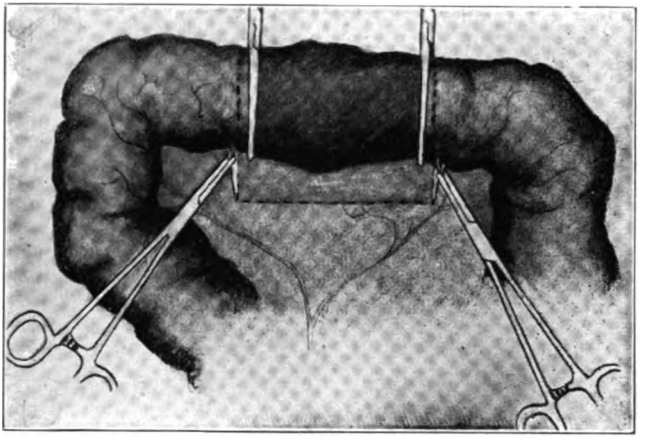

Fig. 2.—Before the bowel is divided, its mesentery is cut close to the bowel wall and the triangular space, caused by separation of the layers of the mesentery just before they cover the bowel, is clamped with a hemostat and ligated with silk or linen. This area is composed of areolar tissue rich in blood-vessels and lymphatics which absorb quickly, and even though it is closed off after it has been inoculated, the germs are merely sealed in and are likely to cause breaking down of the union at this point later on. The procedure indicated in the cut obviates this and also brings together the peritoneum at this point.

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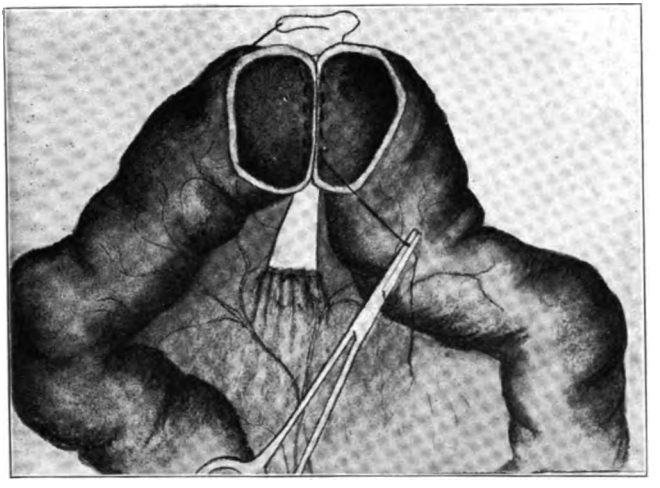

Fig. 3.—The first stitch starts in the end of the bowel at the operator's right hand about one-third of an inch from the mesenteric border. It is a mattress stitch and penetrates the wall of the right bowel from within out. The needle is then carried across to the left end of the bowel and penetrates all coats, entering on the peritoneal surface and emerging from the mucosa. It comes back in the reverse direction, entering the mucosa and emerging on the peritoneal surface, then enters on the peritoneal surface of the right bowel and emerges on the mucosa. The thread is tied, leaving an end about four inches long which is grasped in hemostatic forceps. The needle is then passed back and forth through all coats of the bowel, suturing away from the operator, and making a continuous mattress stitch. After about one-third of the circumference has been sutured, the needle emerges from the lumen of the right end of the bowel and is then thrust through all walls of the right end from within out, appearing on the peritoneal surface of the right end. The stitch is then continued as a right-angled suture penetrating all coats of the bowel.

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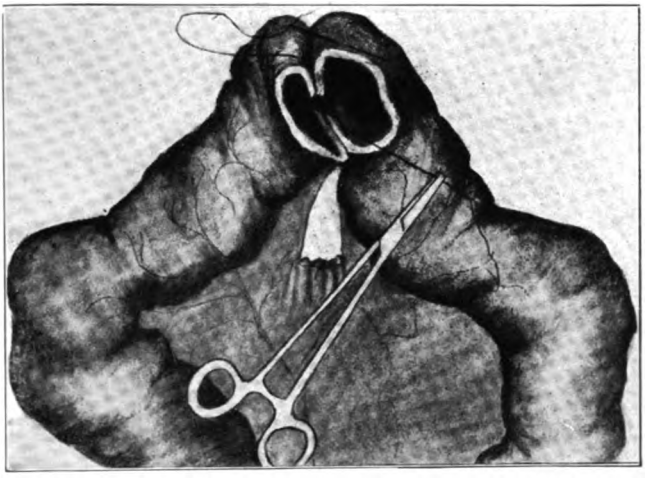

Fig. 4.—The suture is continued, inverting the bowel edge as it goes. A back-stitch should be taken at every fourth stitch. This is done by taking two stitches on the same side, the last one being slightly further back than the preceding stitch. This makes it impossible to draw the threads so tightly as to cause puckering and too great diminution of the lumen of the bowel.

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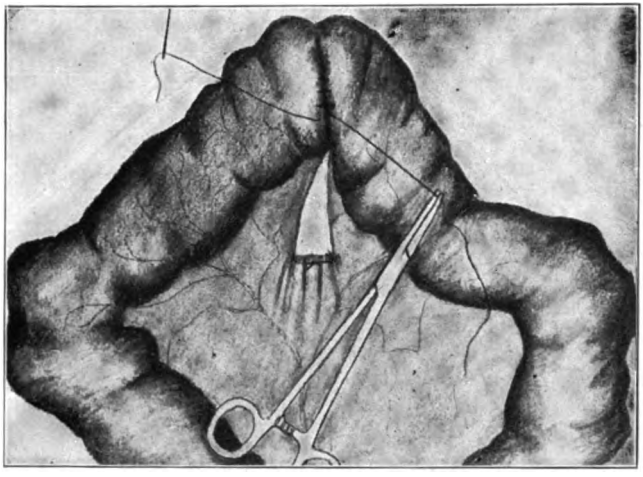

Fig. 5.—The suturing has been completed, the last stitch being taken in the left end of the bowel slightly beyond the lowest point where the original end of the thread comes out. The knot should be snug and should be tied parallel to the line of sutures so that it will sink in easily. The ends should be cut short and will sink into the lumen.

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DR. A. GOLDSPOHN, Chicago: One feature in technic in favor of side-to-side anastomosis is that an aseptic field for work is preserved to the last moment, when the second intestinal lumen must be opened, because both ends of the bowel

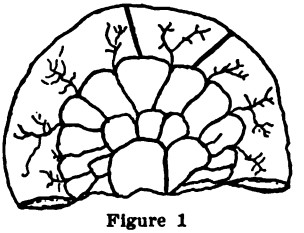

Figure 1

first cut in two have been turned in and closed. When the first bowel is severed with a cautery, however, as mentioned by Dr. Horsley, the same advantage can be secured for an end-to-side anastomosis by cutting off the eschar from the used end of the first bowel finally at the same time that the lateral incision is made into the second bowel involved—both being done after the posterior row of seroserous stitches has been placed. I had occasion to do this recently in an ileo-sigmoid anastomosis in a young woman who had an extreme elongation and descensus of the transverse colon, after three previous abdominal sections. The amount of digestive disorder (sometimes accompanied with much pain) experienced in that case for about eight weeks after this

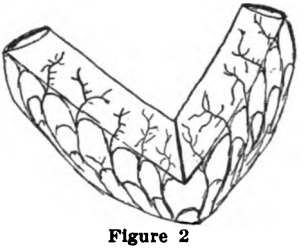

Figure 2

exclusion of the large bowel suggests careful deliberation before taking this step. The technic of circular enterorrhaphy —which Dr. Horsley describes and which he has published before, I have found to be practical and more simple than that of Dr. Connell.

DR. J. S. HORSLEY, Richmond, Va.: It is true that some fecal matter accumulates in the large bowel, but not a large amount, and even that amount is to some extent obliterated by the constant flow of liquid feces. The part that does become hard is softened by the constant flow of liquid feces and peristalsis is carried on. The point is well taken. The description was merely diagrammatic.

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LOCAL AND SPINAL ANESTHESIA IN GYNECOLOGY AND OBSTETRICS

GEORGE GELLHORN, M.D.
ST. LOUIS

That there is in surgery a field for anesthesias other than by way of the ordinary ether drop-method is so indisputable a premise that I need not waste the few moments at my disposal with argumentation. Suffice it to say that there are no statistics in existence which give a true picture of the alleged harmlessness of the open ether-inhalation narcosis. The exact number of fatalities due to ether will never be known, nor has the rôle of ether in the causation of postoperative complications which endanger life and health of the patients ever been exhaustively considered. Few men have the courage to publish their failures, and the medical journals, as Sellheim remarks, "serve as a medium for recounting accidental success rather than the reverse."

Of the large number of new modes of anesthesia and modifications of old ones, gynecology has been particullarly benefited by the two methods which I wish to discuss more in detail—local and spinal anesthesia.

We know both from clinical observations and anatomic researches that the cervix uteri is but meagerly supplied with sensory nerve-endings. Scarifications of the vaginal portions or excisions of small pieces for microscopic examination can usually be done without causing any pain. Under these circumstances it seems to be somewhat out of proportion to employ the heavy artillery of an ether-inhalation narcosis when the injection into the cervix of a small quantity of cocain, novocain, alypin or other drugs will produce an analgesia sufficient for

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the performance of most of the minor gynecologic operations on the uterus. There is, of course, the objection that the patient retains her consciousness and may therefore suffer a psychic trauma. This objection is largely theoretical. It is undoubtedly a difficult matter to break away from long-established habits. If local and spinal anesthesia—for the same objection has been raised against the latter method and may as well be anticipated here—if, I repeat, local and spinal anesthesia had by chance been discovered earlier than ether narcosis, we may well assume that most of us would look on a state of unconsciousness as a disquieting and questionable innovation.

We must further bear in mind that, though the patient is conscious during local or spinal anesthesia, her sensibilities are not nearly so acute as those of the operator or the audience. Any anesthesia should begin at least a day prior to the operation. Excessively nervous patients should receive bromids, valerian or other sedatives as soon as they enter the hospital. Veronal should be given on the evening preceding the operation to insure sound sleep, and hypodermic injection of morphin-atropin, morphin-scopolamin, or the like, should be administered one-half hour before the time set for operation. Before the patient enters the operating-room, the eyes should be covered with a mask, and the ears filled with cotton saturated with olive-oil. By this preparation the patient's apprehension is dulled, and, if there is no sensation of pain during the operation, there can be no psychic shock. A single trial of these methods will disarm even the most profound skeptic. After all, preparations of this kind should precede any anesthesia, whether local or general, and it is to the lasting merit of Crile that he has formulated in so precise and scientific a manner the principles of anoci-association toward which many of us have groped empirically.

LOCAL ANESTHESIA

The technic of local anesthesia is simple. In my first operations a solution of cocain, varying in strength from

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0.25 to 0.50 per cent. was used. These cases were reported by Dr. S. J. Wolfermann.[1] Warned, however, against the toxicity of the drug by a case of marked idiosyncrasy, I have, for the past months, used novocain exclusively. This drug, combined with a very small quantity of suprarenin, is put up in tablets which are dissolved in normal saline solution so as to represent a concentration of 1.25 per cent. The total amount of solution needed hardly ever exceeds 10 c.c. A strong metal syringe with fine hypodermic needles, of the kind used in dental work, is also required. Both the solution and the syringe are sterilized by boiling.

For injection, I have frequently adopted the technic of Hertzler,[2] who injects small quantities of his solution around the periphery of the cervix and into the broad ligaments blocking the nerves before, or at their entrance into, the cervix proper. In other cases I have simply thrust the entire length of the hypodermic needle into the substance of the cervix at the four points of the compass.

There are no other departures from the usual procedure. The patient is prepared as for any vaginal operation and is then placed in lithotomy position. A speculum is introduced into the vagina, and the cervix is grasped with a vulsellum. The application of the vulsellum causes a momentary pain which is felt more or less severely by a nervous patient unless she is told beforehand just what to expect. The uterus is then pulled gently toward the vulvar orifice. Brisk downward traction must be avoided because a jerking or severe pull on the ligaments is unnecessarily painful. When the vaginal portion of the cervix appears near the vulva, it is painted with a solution of equal parts of tincture of iodin and alcohol, and the novocain solution is injected in one of the two ways mentioned before.

The blanching of the cervix due to the action of the suprarenin, which occurs within a minute or two, indi-

1. Wolfermann, S. J.: Local Anesthesia in Minor Gynecology, Jour. Missouri Med. Assn., 1913, ix, 360.
2. Hertzler, A. E.: Local Anesthesia, monograph, 1913.

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cates that analgesia is accomplished and that the operation may commence. All of the operations done in this manner consisted of, or else started with, a curettage. The cervix is slowly dilated with steel dilators, and I have repeatedly been surprised at the ease with which the internal os yielded to the dilatation. After the desired degree of dilatation is obtained, curettage is performed in approved fashion. Occasionally it has been necessary to inject an additional syringeful of the solution into the cervix a little nearer to the mucosa or to insert a narrow strip of gauze saturated wtih the novocain solution into the uterine cavity for about five minutes in order to render the curettage absolutely painless. In the majority of cases, however, these additional precautions are not needed. After the curettage, trachelorrhaphy or amputation of the cervix as indicated in a given case is performed without causing the slightest degree of pain. In like manner a pinhole os may be incised or the Dudley operation for pathologic anteflexion performed. Wound healing was perfect in all cases observed, for it must be remembered that the small amount of fluid used does not produce an infiltration which might interfere with primary union.

So complete is the analgesia, that I have performed a thorough curettage in several instances in my office; I do not, however, wish to recommend this procedure as a routine measure.

When subjected to thorough excochleation patients with inoperable cancer of the uterus suffer rather severely, as a rule, from the combined shock of the inevitable hemorrhage and the ether. These patients do much better under local anesthesia. Novocain has not been satisfactory in these cases. We still employ in this class of cases a cocain solution of 0.5 per cent. In one case in which a 1 per cent. solution of cocain was used, the patient complained of numbness in one leg lasting twenty-four hours. The excochleation is the first step in the acetone treatment, which in itself is quite painless if properly applied.

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In a case of vesicovaginal fistula I obtained complete analgesia by injecting a 2 per cent. novocain solution through the urethra into the bladder. The escaping fluid sufficiently anesthetized the edges of the fistula to permit of a painless operation which resulted in permanent cure.

Local anesthesia is not well suited to colporrhaphies and perineorrhaphies, as analgesia can be obtained in this region only by infiltrating the tissues. This interferes with primary union, consumes too much time and renders recognition of the various layers too difficult for practical use. I have attempted perineorrhaphy by blocking the pubic nerves as recommended by Ilmer and Sellheim,[3] but have given up this method after two decisive failures.

In obstetric work injection of novocain solution into the cervix is an ideal method in cases of incomplete abortion. Reduced by fever and weakened by hemorrhages, these patients often stand an ether narcosis so badly that the cleansing of the uterus of ovular remnants almost assumes the character of a major operation. I prefer the use of very large curets, both sharp and dull, too large to cause perforation; the necessary degree of dilatation of the cervix, softened, as it is, by pregnancy, is exceedingly easy and absolutely painless after injection of novocain. Since resorting to local anesthesia in these cases of abortion, we have observed a much more rapid convalescence, without having to resort to artificial stimulation either by drugs or proctoclysis.

The injection of novocain has been very helpful in cases of induction of labor by means of bags because the necessary dilatation could be secured without any discomfort. Further experiments will have to show whether or not the painfulness of the first stage of labor can be reduced by this method.

3. Ilmer, W.: Importance of Isolated Local Anesthesia of the Pudendal Nerve in Operations on Scrotum, Perineum and Anal Region, Zentralbl. f. Gynäk., ed. 3, 1910, xxxiv, 689; abstr., THE JOURNAL A. M. A., July 2, 1910, p. 95. Sellheim, H.: Local Anesthesia of the Pudic Nerve in Gynecology and Obstetrics, ibid., p. 897; abstr., THE JOURNAL A. M. A., Aug. 6, 1910, p. 544.

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Summarizing, then, I may say that by the injection of novocain into the cervix it is possible to perform a number of minor gynecologic operations without danger and discomfort to the patient, and that in obstetric practice the proper treatment of incomplete abortion has been considerably improved by the use of local anesthesia. This method also offers a promising outlook for the management of cases at or near full term.

SPINAL ANESTHESIA

Spinal anesthesia is, at present, passing through a renaissance in the very country which gave it its birth. Not until sixteen years after Corning of New York had discovered spinal anesthesia, and only after Bier of Berlin had independently discovered the same method and Tuffier of Paris had demonstrated its wide applicability before the International Congress in 1900, was the new method adopted in this country, and our medical literature of twelve years ago reflects the wave of enthusiasm that had spread through most of our large surgical amphitheaters. Disappointments, however, which usually travel in the wake of a novel method used too enthusiastically and indiscriminately during its infancy, brought about an inevitable reaction, and spinal anesthesia was denounced as unreliable and dangerous with the same vehemence with which it had been praised before. The failures and fatalities of Jonnesco, which were so closely watched during his visit to our country, were laid at the door of the method, instead of at the door of that surgeon's personal technic. Then followed silence, and the American literature of the last six or seven years would have been sterile except for the contributions of Morton of San Francisco, who steadfastly clung to his convictions. In the most recent past, however, the papers by Allen,[4] Babcock, Bainbridge and a few others have revived the proposition.

4. Allen, Freeman: Spinal Anesthesia, THE JOURNAL A. M. A., Nov. 23, 1912, p. 1843.

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In Germany the majority of the general surgeons rejected spinal anesthesia after Hohmeier and Koenig had collected statistics from 2,400 cases, with a large proportion of deaths and other serious complications. The gynecologists, on the other hand, not only retained the method but also perfected its technic. Sellheim,[5] in 1909, reported one thousand major gynecologic operations under spinal anesthesia with but one death and few disturbances. Kroenig,[6] in 1912, recorded 2,542 spinal anesthesias with no fatality or complication except two asphyxias, which yielded promptly to appropriate treatment. Figures of this kind can no longer be ignored or challenged because of the failures of earlier days. An impartial consideration, therefore, of the value of spinal anesthesia, particularly in our special field, is timely; but we must profit from the past and refrain from bringing discredit on the method by too extreme enthusiasm, and we should carefully weigh its limitations and realize that the success of the new method depends on close attention to even the minutest details of the technic.

To the younger generation of physicians who have grown up in the use of lumbar puncture the idea of injecting a fluid into the spinal canal is not altogether foreign. The fundamental principle of spinal anesthesia is this: to render analgesic those segments of the spinal cord which supply the innervation of the regions on which we wish to operate. If we inject an anesthetic into the space between the second and third, or the third and fourth, lumbar vertebrae, only the sacral plexus and the lower part of the lumbar plexus are affected. This means for our gynecologic work that, in the main, only the external genitals can be operated on without pain. For laparotomies or for vaginal celiotomies higher spinal segments must be anesthetized. In order to accomplish this object, we must drive the anesthetic within the spinal canal upward from the point of injection. There

5. Sellheim, H.: History, Anatomy and Technic of Spinal Anesthesia, Med. Klin., 1910, vi.
6. Kroenig: In Doederlein and Kroenig's Operative Gynaekologie, Leipzig, 1912.

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is a limit to this upward extension, for, if the anesthetic reaches the medulla oblongata, it will paralyze the respiratory center and the patient will cease to breathe. Spinal anesthesia has this danger in common with inhalation narcosis, for in the latter the narcotic agent enters the circulation and may, if pushed too hard, paralyze the centers for the heart and lungs.

We succeed in anesthetizing the spinal segments as required for our purposes and yet avoid affecting the medulla by observing the following precautions:

1. Only a small quantity of a highly diluted anesthetic is used.

2. The specific gravity of the anesthetizing solution must be higher than that of the cerebrospinal fluid so that it may ascend within the latter. This progress is facilitated by a slight upward current in the cerebrospinal fluid which was first demonstrated experimentally by Quincke[7] in 1872.

3. To prevent too rapid an ascent, the fluid must be injected very slowly.

4. For the same reason the patient should remain motionless in sitting posture for at least three minutes after the injection, because Straub and Gauss[8] have shown that within this period of time the greater part of the anesthetic becomes chemically bound to the substance of the spinal cord. Such an affinity between nerve substance and cocain was first observed by Mosso and Franck[9] in 1892.

5. The remainder of the anesthetic is permitted to reach higher parts of the spinal cord by changing the sitting position of the patient into the dorsal position and slowly raising the lower end of the operating-table. If this entire change is made too abruptly, the current within the cerebrospinal fluid will be increased and the

7. Quincke: Quoted from Gerstenberg, Ztschr. f. Gynäk., 1907, lix, 180.
8. Straub and Gauss: Quoted from Doederlein and Kroenig's Operative Gynaekologie, ed. 3, Leipzig, 1912.
9. Mosso and Franck: Arch. de physiol., 1892, p. 562.

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anesthetizing solution may be precipitated toward the medulla. Failure to observe this caution accounts for many of the collapses which occurred so often during the experimental stage of the new method.

6. Nervous apprehension on the part of the patient perhaps increases the current within the cerebrospinal fluid. It is therefore advisable to eliminate this possible factor by systematically quieting the psyche of the patient in the manner previously outlined.

Some of these precautions may be merely theoretical, but the fact remains that, by observing them, the disastrous complications of former days have practically disappeared in the work of competent observers, and one can only agree with Kroenig when he demands that reports of complications due to spinal anesthesia must hereafter contain all details of the technic employed before they can be admitted to serious consideration.

After these more general remarks, the various steps of the procedure, as I practice it, may be enumerated.

The patient is prepared for the operation in the usual manner; the back is washed the day before and protected from accidental contamination by the clean binder which holds the abdominal dressings in place. She receives a dose of veronal the night preceding the operation to insure sound sleep. A hypodermic injection of morphin, 1/6 grain, with atropin, 1/150 grain, is given one-half hour before the operation. At the appointed hour the patient is placed on the operating-table in sitting posture bent forward as much as possible, and the lower part of the back is painted with iodin solution. An imaginary line connecting the crests of the iliac cones crosses the fourth spinous process which enables us to quickly locate the desired spot for injection. Many authors prefer the space between the second and third vertebrae; I have usually selected the space between the third and fourth. The spinal cord, as a rule, terminates at the upper end of the second lumbar vertebra; it may, however, extend lower down, usually in children, occasionally in women; and

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in such an anomaly an injury to the cord itself seems possible. Below the termination of the cord the nerve trunks, as is well known, are arranged in two large strands with a small intervening open space filled with spinal fluid. It is in this free space that we wish to inject the anesthetic. The needle is then inserted immediately below the spinous process and exactly in the median line. The injection through the skin and the strong interspinous ligament is slightly painful, and the patient must be warned to keep her position lest the needle be broken by the pressure of the spinous process during a sudden jerk. Then the needle is pushed in an inward and at the same time slightly upward direction until the arachnoidal sac is entered, which is evidenced by the escape of colorless fluid. Only a few drops of this fluid are permitted to escape. The syringe previously filled with the anesthetizing solution is at once connected with the needle and the solution diluted in the syringe by drawing the cerebrospinal fluid into it. After a preliminary trial with stovain, I now use exclusively 2 c.c. of a 10 per cent. novocain solution which contains 5 drops of a 1:1,000 solution of suprarenin.† The diluted solution, measuring in all 6 or 8 c.c., is then slowly injected into the spinal canal, the needle withdrawn, and the site of injection quickly covered with gauze or cotton and sealed with collodion. The patient remains bent forward three minutes more and is then *slowly* laid down in the dorsal position. The final disinfection of the abdomen, or in the case of vaginal operation, of the vulva and vagina, is attended to immediately, the lower end of the table is raised slightly and the operation can begin at once.

The way in which spinal anesthesia affects the patient follows a certain order. She first notices that the feet feel heavy and "sleepy." The sense of pain becomes abolished first while the sense of touch as yet persists; then this sense, too, disappears. Gradually the recognition of differences of temperature, tendon reflexes and finally

† I am now injecting, with equally good results, 3 c.c. of a 5 per cent. solution of novocain with suprarenin.

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the mobility of the legs is lost. At last the peritoneum loses its sensibility. The patients breathe quietly and regularly and the intestines are not pressed out of the wound. The abdominal walls relax completely so that abdominal retractors can be used without difficulty.

The analgesia lasts, as a rule, from one to one and one-half hours; in some of my cases it has lasted as long as two and one-half hours. The sensibility of the peritoneum is the first to return, the sensibilities of the other structures following in quick succession. The analgesia lasts longest in the region of the external genitals.

Since my report of the first forty operations performed by me in the manner described I have done twenty-three additional operations under spinal anesthesia. In two other cases spinal anesthesia was attempted but not carried out, in one because only blood was drawn, in the other because of too small a quantity of spinal fluid to dilute the novocain solution.

Of the sixty-three cases, the records of the first twelve are lost. They were for the most part vaginal operations; there was no complication in any of them and the anesthesia was perfect in every instance. Of the fifty-one cases of which I possess accurate records there were thirty-seven laparotomies and fourteen vaginal operations. These group themselves as follows:

LAPAROTOMIES

14 panhysterectomies for inflammatory disease of the adnexa (pus-tubes; tubo-ovarian abscess).
10 hysterectomies for fibroids.
2 hysterectomies for fibroids and pyosalpinx.
2 radical operations for uterine cancer.
1 operation for ovarian cancer.
1 operation for postoperative hernia.
1 operation for ectopic pregnancy (ruptured).
2 operations for fixed retroflexions with extensive adhesions.
1 operation for fixed retroflexion, tubo-ovarian cysts, hernia, and appendicitis.
1 operation for enormous hydrosalpinx and appendix.
2 operations for appendicitis.

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VAGINAL OPERATIONS

5 radical hysterectomies for uterine cancer.
3 hysterectomies for fibroids.
1 vaginal cesarean section for exophthalmic goiter in pregnancy.
1 operation for complete tear in patient with exophthalmic goiter.
1 hysterectomy for prolapse.
1 Watkins-Schauta operation for cystocele.
1 Vineberg operation for retroflexion and cystocele.
1 hysterectomy for fixed retroflexion and tumor in parametrium.

In several of the vaginal cases plastic operations on cervix or perineum were done in addition. The age of the patients ranged between 17 and 64 years. Of these sixty-three operations, analgesia was altogether insufficient in one case, that of a complete tear in a woman with exophthalmic goiter. This happened to be the first case in which I attempted to operate under spinal anesthesia. I used stovain for the first (and last) time, and the solution was apparently too weak. Two years later I performed vaginal cesarean section on the same patient. This time I injected novocain and had a perfect result.

In three other cases the analgesia was imperfect. In one of these, abdominal hysterectomy proceeded quite smoothly for about fifteen minutes under spinal anesthesia; after this a fairly large amount of ether was needed to complete the rather complicated operation. The cause of failure was not clear, unless it was the instability of the solution. The manufacturers have since informed me that the solution, which is put up in sterile ampules, has but a limited stability and for this reason they are now compounding the novocain and suprarenin in tablet form.

In two other cases with imperfect analgesia the cause of failure was a faulty technic. Both were vaginal hysterectomies, one for multiple fibroids, the other for cervical cancer. In neither of these was the patient put in the Trendelenburg position, and the novocain apparently did not reach sufficiently high spinal segments, for in

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both the pull on the uterus and incision of the peritoneum caused intense pain which required administration of ether. In the case of cancer, in which an extended vaginal operation was done, a further cause of failure may be sought in the fact that the needle did not fit well on the nozzle of the syringe, so that some of the cerebrospinal fluid and of the novocain solution was lost.

In six of the remaining forty-seven cases a few whiffs of ether had to be given; in two cases in the beginning because of great nervous excitement of the patient; in the other four at the end of long and severe operations when the suturing of the abdominal walls was under way.

In all other operations, forty-one in number, there was a complete absence of pain. Now and then I had an assistant give a few drops of alcohol on a mask for the sake of suggestion when the patient did not fall asleep at once, but for the most part the patients were perfectly comfortable and were roused only by questions put to them in a loud voice. They paid little or no attention to any remarks made by the operator or assistants and it is altogether a mistake to speak in whispers or to maintain an unbroken silence. "The best plan," says Allen, "is to act as naturally as possible, assuming that the patient is all right and not disturbing her with questions as to her sensations or lack of them. If the patient is nervous or in a communicative mood it is a good plan to detail some agreeable nurse or assistant to sit by her and act as mental anesthetist."

The insertion of the needle and injection of the solution are practically painless. I can here refer to my former paper[10] on this subject. Only in two of the earlier cases was a severe pain experienced which lightning-like radiated into one leg. In these cases the needle was obviously not inserted exactly in the median line and was driven into one of the sacral nerves. In this connection I may point out that spinal injection, like

10. Gellhorn, George: Spinal Anesthesia in Gynecology, Jour. Missouri Med. Assn., 1913, ix, 357.

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any other procedure, requires practical experience and is therefore best left in the hands of one and the same man. I have personally attended to the injections in the last forty odd cases and I believe that with growing skill the procedure becomes proportionally easier and the results more certain.

The symptoms which may arise during anesthesia require particular consideration. The most dreaded complication is that of collapse, which figured so prominently in the earlier publications on spinal anesthesia. I have observed a collapse of this kind in one of my earliest cases, that of a stout and asthmatic woman with nephritis and a flabby heart in whom vaginal hysterectomy was to be performed. In this case, a typical collapse occurred when the patient was brought from the sitting into the dorsal position even before the operation had commenced. An injection of strychnin and the introduction of oxygen quickly revived her, and the operation was successfully and painlessly carried out. In another case, that of a poorly nourished prostitute whose vitality was greatly lowered, air-hunger occurred twice in the course of a tedious operation of almost two hours' duration, but it subsided without any treatment.

Vomiting took place in a large number of cases, usually when the peritoneum was incised. This vomiting varied from simple retching to emesis of copious quantities of fluid, but never persisted.

Since starting the employment of spinal anesthesia the total number of patients operated on was 359 with a mortality of 8, or 2.2 per cent. (exclusive of the operations under local anesthesia); of these 63 were patients operated on under spinal anesthesia with a mortality of 4, or 6.4 per cent. It is significant that spinal anesthesia was insufficient in 2 of these 4 cases, and ether had to be given from the beginning. One of these was an extended vaginal operation for cancer of the cervix. This patient died of shock. The other patient died of peritonitis possibly caused by an injury to the intestines. The remaining two patients died of sepsis: one had

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cancer of the cervix and died five days after a Wertheim operation; the other had a large myxomatous fibroid with most extensive adhesions and died two weeks after operation. I have given my observations in detail, although I am fully aware that my small statistic can in no wise compete with the impressive number of gynecologic operations reported from foreign clinics. But they reproduce on a small scale the experiences gained abroad, as illustrated by the following table. Selheim reviews one thousand major gynecologic operations under spinal anesthesia; three-fifths of these were abdominal and two-fifths were vaginal operations. In these one thousand operations he observed complete and undisturbed anesthesia in 86.1 per cent., and a total of disturbances in 13.9 per cent.

Namely: Complete failure of anesthesia in.....2.3 per cent.
Incomplete extent of anesthesia.....4.5 per cent.
Necessity of inhalation narcosis after satisfactory spinal anesthesia of one hour.....5.4 per cent.
Small amount of ether because of vomiting and straining .....1.7 per cent.

The behavior of patients during an undisturbed spinal anesthesia differs favorably from that of patients operated on under ether and gives the operator a pleasant feeling of security. After operation, this difference is even more marked. All postoperative phenomena occur, as a rule, in mitigated form, and the resisting power of the organism is not reduced by any late effects that might occur after an inhalation narcosis. The wound pain alone is not materially lessened when once the effect of spinal anesthesia has worn off. It is significant that nurses have repeatedly assured me that these patients are more easily taken care of. Catheterization is always needed within the first twelve hours after operation; after this, spontaneous urination occurs, on the whole, more frequently than after ether, and intestinal peristalsis is certainly less affected than after inhalation narcosis.

The most annoying sequel to spinal anesthesia used to be an intense and intractable headache lasting for

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hours or days. I have observed this complication but once, in the case of vaginal hysterectomy for multiple fibroids previously referred to when spinal anesthesia was insufficient and a good deal of ether had to be added. It existed from the third to the ninth day after operation, but finally yielded to hot packs. The comparative freedom from these distressing headaches in my cases may be explained in this way: (1) The instruments for injection are boiled in plain water instead of soda solution; (2) the cerebrospinal fluid is not permitted to escape so that the pressure in the spinal canal is not lowered. Conversely, patients from whom from 6 to 10 c.c. of fluid are taken by lumbar puncture for examination always suffer from severe headaches.

Kroenig observed headaches in 897 out of 2,074 cases, or 47 per cent. He remarks that the choice of the anesthetic plays no part in the causation. The frequency and intensity of headaches depends more on the social stratum and the age of the patients. Wage-earners, women from the rural districts and those beyond the age of 50 suffered less; neuropathic persons suffered severely from these headaches.

Backache lasting one or two days was noted in five of my cases. In two instances the bed-side notes recorded numbness in the legs, and one patient complained of pain in the feet on the day following the operation. Usually, however, free mobility of the legs is regained within an hour or two after operation.

A partial paralysis of the lower extremity, which, however, gradually subsided, was observed in the one case previously mentioned in which the needle probably had entered one of the sacral nerves. One patient, who had stood an abdominal hysterectomy for fibroid exceedingly well, developed a slight psychic disturbance during the next two days, but eventually recovered completely.

Sellheim saw in his one thousand operations trophoneurotic disturbances of the skin in 1 per cent., and paralysis of the abducens in 0.1 per cent. All of these phenomena disappeared spontaneously. His statistics

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appeared in 1909, and it seems to me from the study of more recent literature that these disturbances have become less frequent. They have been absent in my own patients.

All these disturbances become insignificant when compared with the great advantages of spinal anesthesia. If we consider the 2,542 cases of Kroenig without a fatality, the one thousand operations of Sellheim with but one death and numerous other large series of cases in literature with an equally low mortality, we may be tempted to conclude that spinal anesthesia should be the method of choice and in practically all major gynecologic operations. As a matter of fact, Doederlein and Kroenig draw just this conclusion. They regard as the chief advantage of spinal anesthesia over inhalation narcosis the fact that in the former we have to deal in the main with a local anesthesia in which the greater part of the poison is deposited around the site of the injection and is thus rendered harmless, while in every inhalation narcosis the poison enters the circulation and produces undesirable toxic effects on the other organs, particularly the heart and lungs. They emphasize further that postoperative cardiac disturbances and pneumonics occur far less frequently after spinal anesthesia than after inhalation narcosis. Patients with bronchial troubles or heart lesions bear a spinal anesthesia better than inhalation narcosis. The latter, it is true, is free from postoperative headaches, but since these do not materially alter the general condition of the patients and do not endanger life, they cannot be considered as an absolute contra-indication to the use of spinal anesthesia. Kyphoscoliosis, on the other hand, and other anomalies of the spinal column contra-indicate spinal anesthesia. The same is true of spinal anesthesia in labor because it has been proved that the nerve substance of pregnant women is apt to be affected irreparably even by small doses of the anesthetic used and further because the analgesia eliminates the action of the abdominal muscles during confinement. They also exclude neurotic

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individuals because of the greater frequency and intensity of postoperative headaches.

These authors, then, prefer spinal anesthesia over inhalation narcosis in all operations with a high mortality, such as operations for cancer and fibroid; but since there is a certain degree of risk in any laparotomy, they use spinal anesthesia in all abdominal operations in preference to inhalation narcosis.

The list of contra-indications as formulated by other authors, who, in the main, concur with Kroenig and Doederlein, also includes fever of unknown origin, sepsis, lesions of the central nervous system, syphilis, pressure-points along the spinous processes which might indicate abnormal conditions within the arachnoidal sac, such as adhesions or lack of cerebrospinal fluid, arteriosclerosis. hysteria, great nervousness and prejudice against the method.

From my own experience, limited as it is, I feel that syphilis need not exclude the use of spinal anesthesia. A large percentage of the patients operated on in the City Hospital and the Barnard Free Skin and Cancer Hospital presented strongly positive Wassermann reactions, yet had no subsequent disturbance attributable to the injection. The amount of cerebrospinal fluid was, however, so small in three of them that in two instances the attempt to inject the novocain solution was given up. It would be interesting to investigate whether or not syphilis reduces the amount of spinal fluid.

I can also assert that psychoses do not necessarily militate against the success of spinal anesthesia, for in two maniacal patients, inmates of the City Insane Asylum, the result of spinal anesthesia was perfect.

With these contra-indications in mind I have employed spinal anesthesia in all cases in which distinct cardiac or pulmonary lesions rendered inhalation narcosis plainly inadvisable. I have furthermore made use of it in patients whose general condition was so weakened either by sickness or age as to render any operation more or

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less hazardous and finally in complicated conditions in which a severe and tedious operation could be foreseen. These guiding principles find their expression in the list of operations given before, which comprises but few uncomplicated cases. It can thus be seen that I have put spinal anesthesia to a particularly severe test. Furthermore, the fact that only one-sixth of all the patients operated on were subjected to spinal anesthesia shows that the method has not been used indiscriminately.

The time is not yet ripe to form a definite estimate of a method that has been in practical use for less than thirteen years. Spinal anesthesia is not applicable in all cases, but neither is there any other method of anesthesia that would be universal. It would, indeed, be contrary to all our principles of individualization in medicine if we were to depend on any one mode of subjecting our patients to operation. It is true that in a certain small percentage spinal injection fails to produce the necessary analgesia. Whether this is due to the nature of the anesthetic used, faults of technic or to factors still unknown, the future will show. It may be possible to still further diminish this small percentage. There are also a number of undesirable by-effects which have steadily decreased with growing experience and will perhaps be reduced later to a negligible minimum. All these shortcomings of the method have been dwelt on in the foregoing pages in order to make an accurate presentation of the problem before us. On the other hand, spinal anesthesia presents many undeniable advantages over inhalation narcosis and, taken all in all, seems to offer an element of safety which would add greatly to the achievements of modern surgery, particularly in the field of gynecology. In view, then, of all that has been said of both local and spinal anesthesia, it is permissible to contend that he who rejects these two methods a priori deprives himself and his patients of valuable means to render his operative endeavors still more efficacious.

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SPINAL ANESTHESIA IN GYNECOLOGY, OBSTETRICS AND ABDOMINAL SURGERY

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In 1885 Dr. J. Leonard Corning[1] of New York published the first article on spinal anesthesia. Not considering it feasible to introduce the solution within the arachnoid, Dr. Corning injected a solution of cocain between the spinous processes in the lower dorsal region of a man and a dog. Although in both instances there were evidences of anesthesia, and although Dr. Corning considered the feasibility of operating under this method, nearly fifteen years elapsed before August Bier at Bonn, Germany, first produced intradural anesthesia. Bier had the experiment made on himself and later injected his assistant, an example of medical heroism that recalls Sir James Y. Simpson's demonstration of the anesthetic value of chloroform. Despite the warning from Bier, the intradural injection was promptly tried in many of the clinics of the world but soon was abandoned from imperfections in the technic and disadvantages attending the use of cocain. In 1902, with the discovery of a series of synthetic alkaloid-like bodies having local analgesic properties, the method was revived and came into larger use. Of these substances, stovain[2], tropacocain and novocain are at present chiefly employed. Cocain has been discarded.

1. Corning, Leonard J.: New York Med. Journal, Oct. 3, 1885.
2. Stovain is named in honor of its discoverer, Fourneau, the French selecting as more euphonious the English translation of *fourneau*—a stove.

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I have employed spinal anesthesia at the Samaritan Hospital since 1904, and our experience is based on over five thousand operations performed under spinal anesthesia by my associates and myself. Except where indicated, I shall here refer only to a personal experience of something over three thousand operations on the abdomen, pelvis and adjacent parts. As a proportion of the patients were subjected to repeated or multiple operations, the number of patients is less than the number of operations. With a similar technic, and with the position of operator and patient reversed, I myself would have accepted spinal anesthesia; and the method is one that has repeatedly been selected by my medical associates, assistants and nurses for operations on themselves or members of their families. This must be my excuse for a rather extensive employment of spinal anesthesia. Cocain, alypin and eucain lactate were used in a small series of cases, and tropacocain and novocain several hundred times each, but stovain has been chiefly employed. The action of a sufficient dose of each of these substances is so similar that a general description will suffice.

PHYSIOLOGIC ACTION

When a solution of a local anesthetic is introduced within the dura it promptly falls or ascends according as its specific gravity is greater or less than that of the cerebrospinal fluid. Cerebrospinal fluid has perhaps the most constant specific gravity of any of the liquids of the body, and in a study of over a hundred specimens taken from patients of different ages and under different conditions we found that the specific gravity almost invariably ranges between 1.0055 and 1.0065. As the slightest variation in specific gravity causes the substance introduced into the cerebrospinal fluid to rise or fall it is not practicable to prepare anesthetic solutions that will remain stationary when introduced within the dura. It is desirable, therefore, to use solu-

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tions either distinctly heavier or lighter than that of the cerebrospinal fluid. As the fluid rises or falls it comes in contact with the motor and sensory nerve roots and arrests their power of conductivity. There follow anesthesia, motor paralysis and sympathetic paralysis in the segments affected. The cord proper surrounded by the pia is only superficially influenced, and the columns within the cord may continue to functionate under spinal anesthesia. The autonomic system is practically uninfluenced. Immediately after the injection the patient usually notices a sense of paresthesia in the feet followed in a very few seconds by complete loss of sensation and almost complete loss of motion. The small muscles of the toes and the ileopsoas muscle group succumb last to the influence. As would be expected, the area of epicritic (pain) loss is much greater than the area of protopathic (touch) loss. If the analgesia is not deep the patient may therefore feel the knife although the incision is not painful. The motor paralysis and loss of motor sense are secondary to the loss of sensation and indicate the full intensity of the action of the drug, the anterior nerve roots being less sensitive to the action of the anesthetic than the posterior roots. Analgesia may be present without complete muscular relaxation, especially if the solution be weak, or a weaker drug like novocain used.

With a sufficient dosage the patient is entirely oblivious of the movement or position of the affected part. The action begins a few seconds after the injection, reaches intensity in fifteen or twenty minutes and then gradually disappears, the total duration of the analgesia varying directly with the dosage, being from fifteen to ninety minutes.

Abdomen.—Under spinal anesthesia the abdominal walls become relaxed, the abdomen more scaphoid. Abdominal breathing is largely abolished. The anal sphincters relax, and the gaseous and liquid content of the large intestine escapes. The intestinal tube con-

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tracts and shows active peristalsis. Except in certain forms of mechanical obstruction, ileus is usually promptly relieved by the injection. The influence on the intestinal tract may be explained largely by the release from intestinal inhibition. The vasomotor sympathetic nerves, the source of intestinal inhibition, are blocked, and the stimulating autonomic influence from the vagi and the stimulus from the ganglia of Auerbach are unopposed.

Operative manipulations within the abdomen are greatly facilitated by the relaxed parietes and contracted intestine, and the expulsion of gas and fecal matter before the patient leaves the operating-table is especially helpful in the forms of ileus. The stomach in some degree shares in the peristaltic stimulation. If the upper dorsal segments are involved, nausea is often noticed, due probably to cerebral anemia. The patient may be unable to vomit with the head raised, from paralysis of the abdominal walls. If present, the nausea is usually very transient. It may also result from mental impressions.

Urinary System.—While we have not made careful estimations of the urinary excretion under spinal anesthesia, it is evidently distinctly diminished as a result of lowered blood-pressure. The ureters show periodic peristaltic waves that are increased in frequency by mechanical stimulation. We have not observed incontinence of urine under spinal anesthesia. A slight or moderate degree of priapism is only occasionally observed, evidence that a marked influence on the lumbar cord is inconstant.

Circulation.—Spinal anesthesia is characterized by a fall in the blood-pressure and a slowing of the pulse that are proportionate to the height and intensity of the anesthesia. With involvement of the upper dorsal nerve roots the pulse may drop to 40 or 30 and the blood-pressure to zero at the wrists, while an involvement of only the lower spinal segments may produce only a

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slight reduction in the pulse-rate and blood-pressure. The action on the circulation begins soon after the motor paralysis reaches its acme or in about fifteen or twenty minutes, and gradually passes off. The influence on the circulation may be explained by the following factors:

1. The pressor influences to the cord are interrupted and there is a vasomotor palsy in the involved segments.

2. The limitation of respiratory movements reduces the normal aspirating influence on the venae cavae, and the right auricle fills slowly and therefore the other cavities of the heart fill slowly.

3. The inhibitory influence of the vagi on the heart continues and is largely unopposed.

4. The powerful normal stimulus to vigorous heart action—the *vis a fronte,* is largely lost with the fall in blood-pressure.

A blood-pressure of zero at the wrist may be harmless if the respirations are well maintained. The hypotonus, however, favors cardiac arrest in certain forms of myocardial disease, as well as in thoracotomy and other operations causing sudden changes in intrathoracic tension. The depression of the heart varies directly as the height of motor paralysis. In aneurysm, threatened decompensation in valvular disease, in the excessive tension of eclampsia, in labor, nephritis and advanced arteriosclerosis the vasorelaxation of spinal anesthesia may be protective. Hemorrhage from divided vessels and from the open uterine sinuses is greatly reduced under spinal anesthesia, while there is no increased tendency to reactionary hemorrhage. No other anesthetic produces such a complete vasomotor relaxation, and for this reason spinal anesthesia should be used with care or avoided in conditions of marked hypotension, while it is indicated in forms of hypertension. During severe shock, spinal anesthesia should not be employed. It accentuates preexisting shock although it prevents to a remarkable degree the production of shock by oper-

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ative measures carried out under its influence. With most other anesthetics the shock of a prolonged operation is reinforced by the progressive toxemia of the anesthetic. With spinal anesthesia the emergence of the nerve roots from the anesthesia as the operation proceeds usually results in the patient's leaving the operating-table in better condition than he was during the early stages of the operation.

The best antidote for the fall of blood-pressure is the intravenous injection of physiologic salt solution containing epinephrin. From 2 to 10 minims of epinephrin should be added to each funnel (6 ounces) of the saline solution, the flow being interrupted as soon as the pulse returns to the wrist. The amount of epinephrin to be used depends on the effect produced; in some instances 2 minims is excessive; in others 70 minims are hardly sufficient. For patients in extremis it is wise to fasten the transfusion needle in a vein before starting the operation as complete cessation of the circulation for over seven minutes seems to be incompatible with life. In certain instances cardiac massage, best carried out through the diaphragm, must also be used.

Respiration.—The respiratory movements diminish in amplitude according to the height of paralysis of the respiratory muscles. With paralysis of the lower dorsal segments the respirations become diaphragmatic in type but are without the coordinate movements of the abdominal walls. As the thoracic walls relax the patient sometimes complains of a sense of weight or oppression on the chest. The skin, although pale is usually dry and of fair color. If, however, the fourth cervical segments supplying the phrenics be influenced, although the patient may continue to make ineffectual respiratory movements with the accessory respiratory muscles of the neck, asphyxia rapidly develops and the patient will die unless efficient efforts at artificial respiration be instituted. If a solution of stovain be applied to the floor

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of the fourth ventricle of a dog the respirations are almost instantly arrested but the animal may eventually recover, provided artificial respiratory movements be continued until the centers emerge from the influence of the drug. A similar condition occurs in the human being in anesthesia of the cervical segments, and one should not hesitate to continue artificial respiration for forty minutes or even longer. The respirations under spinal anesthesia are usually slow, and rather shallow. Their small amplitude is favorable to the performance of abdominal operations. Cyanosis is ominous. Respiratory movements are best gaged by a wisp of cotton fastened to the tip of the patient's nose, and this is the best indicator of the efficiency of artificial respiratory measures. If artificial respiration is necessary it can conveniently be carried out by rhythmic compression of the thorax or by forced artificial respiration. A simple emergency method of forced artificial respiration is by intermittently blowing through a soft rubber hose applied over a tracheotomy tube. Resuscitation by the intratracheal insufflation of Meltzer is less convenient and in my experience, less positive. It is absolutely essential that the upper respiratory passages are kept open.

Uterus.—Uterine contractions continue under the anesthetic, but being without the normal aid of the voluntary expulsive forces, they are, as a rule, inefficient even when supplemented by the associated relaxation of the pelvic outlet. The blood-pressure in the uterine sinuses is greatly reduced. Hemorrhage during delivery or during curettment for miscarriage is distinctly less than that seen under chloroform or ether anesthesia. When emptied, the uterus contracts promptly, and I know of no instance of secondary hemorrhage after delivery.

Skin.—Except with the relaxation of high spinal anesthesia, the surface of the body is pale or of normal color, and dry. The suffusion of the skin, drenching sweats and heat radiation of ether are absent.

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It is evident that spinal anesthesia has a different physiologic action than that of any other anesthetic. It is of chief value when its application is based on its peculiar physiologic action and when it is used in conditions that render the employment of other anesthetics dangerous.

PERSONAL EXPERIENCE OF THE AUTHOR

In detail, my personal experience is as follows:

TABLE 1.—OPERATIONS ON THE UPPER ABDOMEN

	No. Cases
Stomach:	
Complete gastrectomy for cancer	8
Partial gastrectomy for cancer	10
Resection for ulcer	7
Occlusion perforated ulcer	18
Gastrostomy	6
Gastro-enterostomy	19
Gastroplication or gastrorrhaphy	14
Exploration for cancer, and miscellaneous	51
	128
Liver, Gall-Bladder and Ducts:	
Cholecystectomy	49
Cholecystostomy	68
Choledochotomy, choledochoduodenostomy	6
Operations on liver for rupture, abscess, tumor hydatid cyst and ptosis	31
Miscellaneous	19
	173
Acute Pancreatitis with Fat Necrosis:	
Cholecystostomy and drainage	5
Spleen:	
Wound	2
Splenectomy for acute leukemia (13½ pounds), massive infarction, Banti's disease	5
Omentum and Mesentery:	
Resection, excision of lymph-nodes, chylous cyst, etc.	19
Total operations on the upper abdomen	332

It is more difficult to produce efficient spinal anesthesia in the upper abdominal segments without depression and the analgesia is associated with certain disadvantages not present when only the lower abdominal segments are involved. The anesthesia usually involves the lower thorax and often reaches the level of the third or fourth rib. This interferes in part with the respiratory movements and increases the fall in blood-pressure, and if sufficiently high may cause nausea and symptoms of shock; while if the analgesia be low, traction on the stomach and manipulations near the diaphragm produce discomfort and nausea. It is

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desirable in many of these patients, therefore, to produce unconsciousness by the preliminary injection of narcotics, but in the weak and debilitated the use of narcotics increases the danger of respiratory failure. The conjoint use of a small quantity of ether at times is less objectionable. In about 80 per cent. of my cases narcotics have been used and in perhaps 5 or 10 per cent. the action of spinal anesthesia has been supplemented on the operating-table by the use of ether. Usually from ½ to 2 ounces of ether will be sufficient for a fairly prolonged operation.

Ill Effects in Operations on the Upper Abdomen.—One patient, not included in Table 1, operated on for a purulent cholecystitis by an assistant, under 10 cg. of novocain, after a preliminary injection of 1/6 grain of morphin and 1/100 grain of scopolamin, developed a fatal respiratory and circulatory failure. This patient was a rather obese middle-aged man with a serious valvular disease of the heart. In my own series, a woman, who had a narcotic and stovain, was drowned by regurgitant vomiting as the operation was being completed. This patient was obese, had a very weak heart and an advanced peritonitis of the upper abdomen from a perforated gall-bladder. The heart action was restored for nearly thirty minutes by cardiac massage and epinephrin, but the Meltzer method of intratracheal insufflation seemed not only ineffective but harmful, and spontaneous respirations were not resumed. These two patients were solemn warnings as to the need of a dependable and capable assistant to watch the gravely ill patient under spinal anesthesia. In both the operator, rather than the person intrusted with watching the patient, first discovered that a catastrophe had occurred. In two cases of advanced intra-abdominal carcinoma the vascular hypotonicity under the spinal anesthesia would have prevented, had it been feasible, an attempt at any serious radical operation. In the

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majority of the cases, however, the patient's condition was satisfactorily maintained despite the very extensive operative measures. In a splenectomy for massive infarction with advanced cardiac disease, the patient had marked decompensation but the operation was completed without difficulty. The patient died two or three months after from the progress of the heart lesion.

TABLE 2.—OPERATIONS ON THE LOWER ABDOMEN

	No. Cases
Appendix:	
Catarrhal, chronic or incidental	610
Gangrenous, perforative with abscess or peritonitis	215
Appendicostomy	4
	829
Intestine:	
Resection (from 3 inches to 16½ feet)	21
Suture or occlusion	17
Occlusion of perforated typhoid ulcer	14
Miscellaneous, including colostomy, fecal fistulas, adhesions, bands, kinks, diverticuli, ileus, abscess, separation of adhesions, etc.	77
	129
Herniotomies and Operations on Abdominal Wall:	
Inguinal	365
Femoral	15
Strangulated	29
Incisural, umbilical, ventral	57
Lipectomies (from ½ to 14½ pounds)	30
Miscellaneous operations	6
	502
Total operations on the lower abdomen	1,460

Spinal anesthesia has its chief value in operations involving the segments of the lower abdomen and pelvis. In these regions it is not difficult to produce relatively safe and complete analgesia with muscular relaxation. Particularly is it valuable in acute peritoneal infections as from the appendix. In these patients, beyond the possible passage of a stomach-tube, and the sterilization of the skin, no preoperative preparation is required. If meteorism or inflammatory ileus exists the intestinal tract is usually emptied on the operating-table and the patient returns to bed with a scaphoid abdomen. The muscular relaxation and collapse of the distended bowel enable the surgeon to work with greater facility and less peritoneal exposure, handling or traumatism than under conventional methods of anesthesia. A shorter incision

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may be made and the anesthetic does not add to the patient's intoxication or interfere with normal elimination.

Ill Effects in Operations on the Lower Abdomen.— In patients with mechanical intestinal obstruction I have had two cases of collapse on the operating-table. In the first there was an enormous abdominal distention interfering with respiratory movements, and artificial respiration was temporarily required. The band producing the obstruction was divided, but the usual evacuation with prompt collapse of the bowel did not occur. The wound was closed with great difficulty, but the patient made an uninterrupted recovery.

The second patient was a feeble woman aged about 75, with a strangulated and gangrenous hernia of about two days' duration. The patient may properly have been considered as inoperable. Respiratory and cardiac failure developed under spinal anesthesia and the patient was revived by artificial respiration and the intravenous use of epinephrin, dying two days later from the progress of the peritonitis.

An obese woman with a strangulated, gangrenous, umbilical hernia and peritonitis received the injection while writhing from tormina on the table. The needle was observed to pass to one side of the median line, and a lightning-like shock down the patient's left leg as the dura was punctured warned me that the needle had impinged a nerve root. The patient was in such a desperate condition that the injection was given without withdrawing the needle. The gangrenous intestine was resected and to my surprise the patient recovered from the abdominal operation but developed a violent left sciatic neuritis with paralysis of the foot which slowly cleared. This is the only evidence of traumatic injury of the cord or nerve roots that I have seen. It is a warning that the needle should at once be withdrawn and properly introduced should root symptoms be noticed during the introduction of the needle.

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With one exception, during the past nine years, I have selected spinal anesthesia for all abdominal operations on the toxic, septic or desperately sick, and I have withheld operation only from those who were admitted to the hospital in an unquestioned dying condition. In a few instances I have even given spinal anesthesia to the moribund. One such patient, a man aged about 70, with a perforated typhoid ulcer of twenty-four hours' duration, was brought to the hospital cold, cyanotic and nearly pulseless, and died during the operation. Although in other hopeless cases of peritonitis the patients have withstood the depression

TABLE 3.—PELVIC AND VAGINAL OPERATIONS

Abdominal Operations on Pelvic Organs:	No. Cases
Hysterectomy and hysteromyomectomy	61
Myomectomy	8
Ovariotomy	7
Operations on tubes and ovaries	148
Suspension operations	54
Miscellaneous	29
Total	307
Vaginal Operations involving the Peritoneal Cavity:	
Vaginal hysterectomy	105
Vaginal myomectomy	1
Vaginal ovariotomy	7
Vaginal appendectomy	7
Vaginal resection or removal of tubes and ovaries	57
Vaginal anterorrhaphy	3
Culdesac drainage	57
Miscellaneous	17
Total	254

of spinal anesthesia, and although the operations have taught valuable but terrible lessons to attending physicians and students, I shall not dispute those who consider it better to permit these unfortunate patients to die under the Ochsner treatment. The lowest mortality I have obtained in operating on the appendix, 1.8 per cent., in a series of 220 consecutive and unselected operations performed promptly after admission to the hospital, irrespective of the degree or duration of any associated peritonitis, has been under spinal anesthesia.

Three patients with apparent mechanical intestinal obstruction of some days' duration, that had resisted many forms of treatment, were relieved by spinal anesthesia alone while the patients were on the operating-table and before the incision was made.

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I have had little trouble from postoperative tympany, and recall no operation required for postoperative ileus, and it is evident that postoperative intestinal disturbances are not increased by the use of spinal anesthesia.

As with operations on the lower abdomen, operations on the pelvic organs are very conveniently carried out under spinal anesthesias. I believed that the sudden deaths from heart failure observed during hysterectomy for large fibroid tumors performed under ether could be avoided under spinal anesthesia, until circulatory and respiratory failure developed in an obese colored woman from whom I had started to remove a large fibroid tumor. In this case the ordinary methods of artificial respiration were ineffective. After repeated cardiac massage and the intravenous injection of epinephrinized salt solution, the heart was finally started after about twenty-five minutes had elapsed. By forced artificial respiration, the respirations were spontaneously resumed after over thirty minutes of cessation. The patient lived for two days in an unconscious condition and died with edema of the lungs.

We recently had a similar experience from nitrous oxid-oxygen demonstrated by an "expert" who was using one of the newest types of apparatus. This patient was of spare build, in very good physical condition, and a simple hysterectomy for chronic adhesions had been undertaken. The patient, after a difficult resuscitation, lived in an unconscious condition with recurrent cortical convulsions, for about twelve hours. In contrast, one operation for inflammatory pelvic disease, one operation for large uterine fibroma with serious cardiac disease, and one operation for advanced carcinoma of the recto-vaginal septum were successfully performed on patients on whom previous attempts had been made to operate under ether in other clinics, but in each instance it had been necessary to abandon the operation on account of the collapse of the patient. While I have not hesitated to employ spinal anesthesias in conditions rendering the

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use of ether hazardous, there are forms of collapse or sepsis in which the necessary operative procedure may be carried out under light anesthesias from a few whiffs of ether. Ether anesthesia in these cases should be preferred to the intense effect of spinal anesthesia.

Spinal anesthesia should be employed with caution in the neurotic, especially those with pelvic symptoms. Frequently they will attribute all postoperative headaches, backaches or pain in the extremities to the intradural injection. At times, under the advice of solicitous friends or unwise medical advisers they become convinced that a hopeless spinal degeneration is developing. It is fortunate if the patients come under the care of a trained neurologist.

TABLE 4.—OPERATIONS ON THE KIDNEY AND BLADDER

	No. Cases
Kidney:	
Nephro-ureterectomy	2
Nephrectomy	10
Nephrotomy or nephrolithotomy	33
Resection of kidney	3
Decapsulation	29
Nephropexy	20
Ureterotomy	2
Perinephritic abscess drained	4
Separation or transplantation of ureter to appendix, intestine, bladder	4
	107
Operations on the bladder	54
Total operations on kidney and bladder	161

Spinal anesthesia seems to have a special value in certain operations on the kidney and bladder. I have not hesitated to operate on both kidneys simultaneously under spinal anesthesia or to do a nephrolithotomy on the residual kidney after the removal of the opposite organ. In one woman aged about 60 the residual kidney had been opened three times previously for recurrent calculi. In a second case, although the residual kidney had been subjected to repeated operations and drained for eighteen months, the patient later married and successfully passed through several pregnancies. From decapsulation performed under spinal anesthesia on patients with advanced forms of nephritis with or with-

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out marked anasarcas, I have observed no untoward effects. The anesthetic seems also of especial value in operations on the bladder, especially in removal or resection for tumor, and for prostatectomy.

TABLE 5.—PLASTIC OPERATIONS, AND OPERATIONS ON RECTUM AND GENITALS

Plastic operations and curettements	287
Operations on rectum and anus	150
Operations on external genitals	106

Spinal anesthesia gives very satisfactory relaxation of the perineal muscles. The relaxation of the anal sphincter facilitates operations on the lower bowel. The anal sphincters are among the last to relax under ether and the first to relax under spinal anesthesia. As in other parts of the body, the lowered blood-pressure reduces the hemorrhage. Curettement for retained products of conception is performed with much less hemorrhage than when ether is used, showing that the uterine sinuses, as well as the veins and arteries, are influenced. I have not observed reactionary hemorrhage from spinal anesthesia; apparently it is less frequent than after the employment of ether, for although fewer vessels require ligation in the operations under spinal anesthesia, hematomas and hemorrhagic extravasations in wounds are infrequent. In operations on the lowel bowel, if the rectum has not been thoroughly emptied to the operation, an evacuation will usually occur on the table. An enema should, therefore, not be used for some hours preceding the operation. Retention of urine after perineal and rectal operations seems to occur after spinal anesthesia with about the same incidence as it does after the employment of ether. I do not believe that the intradural injection is a causal factor in this condition. As indicating the innocuousness of repeated intradural injections, one patient has been subjected to spinal anesthesia not less than eleven times for repeated plastic operations for hypospadias without evidence of cord or root injury.

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For a report of 173 of the cases given in Table 6 I am indebted to Dr. J. C. Applegate, obstetrician to the Samaritan Hospital. Dr. Applegate considered the condition of 60 per cent. of these patients such as to render the use of ether or chloroform undesirable. A number of the patients were exsanguinated. In the case of cesarean section the uterus had ruptured sixteen hours previous to the operation and the fetus was in the abdominal cavity. The patient was brought about 20 miles to the hospital and was pulseless. Although the patient seemed to be moribund when the operation was started, she made a satisfactory recovery. The heart

TABLE 6.—OBSTETRIC OPERATIONS

	No. Cases
Version	6
Induced labor	1
Manual extraction of 4 months	1
Dilatation and curettement	214
Forceps deliveries	36
Vaginal drainage for pelvic infection	17
Ectopic pregnancies	16
Cesarean section—ruptured uterus	1
Placenta praevia	8
Podalic version	3
Total	303

action was maintained during the operation by the intravenous use of epinephrinized salt solution. Dr. Applegate reports no diminution of the uterine contractions, and no post-partum hemorrhage or other ill-effects after spinal anesthesia in his service.

I am also indebted to Dr. William A. Steel of the surgical service of the Samaritan Hospital for 109 of the cases given in Table 6, many of them treated in his private practice under the disadvantages incident to a poor home equipment. Dr. Steel notes that the uterine contractions were not abolished, that hemorrhage was markedly lessened, that the placenta may be expelled spontaneously, and that the after-coming head in breech or version operations must be extracted rapidly or else the lower uterine segment may contract on the neck. He has not employed spinal anesthesia in normal labor and doubts that the uterine contractions would be sufficient to force out the fetus.

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Dr. Steel considers the following as advantages:

1. The ability in private practice to handle emergency obstetric operations without an anesthetist or trained assistant.

2. The immediate soothing mental effect on the patient from the cessation of her suffering. Experience has shown that this is the one operation in which even the most nervous woman prefers consciousness.

3. The aid rendered by the patient herself in holding to the side of the bed, with arms over her head, in a difficult forceps delivery.

4. The comparative lack of bleeding during delivery and the natural expulsion of the placenta due to the persistence of uterine contractions.

5. The perineal anesthesia and muscle relaxation, permitting immediate painless, thorough repair work.

6. A striking advantage in the entire lack of the "whistling" hemorrhage so often annoying in curettements for retained secundines under ether relaxation.

In a personal communication Dr. James P. Marsh of Troy, N. Y., reports four successive and successful cesarean sections for eclampsia. The reduction of blood-pressure and the saving of time render the method of value.

In version and threatened uterine rupture the method may be used. Uterine inertia is probably less frequent after spinal anesthesia than after ether.

The danger of pregnancy to the woman with pulmonary tuberculosis is from the violent physical strain of labor. I am indebted to Dr. H. R. M. Landis for the suggestion that child-bearing may be rendered relatively safe to the tuberculous by an instrumental delivery under spinal anesthesia. In one primipara with a large pulmonary cavity, this method was employed with entire satisfaction. The patient had no labor pains or secondary ill effects, and a living child was easily extracted

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under spinal anesthesia. In pregnancy associated with serious heart disease the method also enables one to obviate all cardiac strain.

In fourteen of the cases in Table 6 I operated for ectopic pregnancy by a free incision through the vaginal culdesac. The affected tube was grasped, pulled down with the vagina, clamped or ligated and excised. A gauze drain was introduced from the vagina into the pelvis and the patient at once returned to bed. This simple operation requires but little time and was found useful in the "tragic" type of ruptured tubal pregnancy. There was no mortality in this small series. Spinal anesthesia has the advantage in obstetric practice of producing no ill effects on the child. In private obstetric practice, Dr. Steel considers that post-spinal cephalalgia is unusually frequent and severe. At present, however, I am inclined to consider postoperative headache and abducens palsy as evidence of the use of deteriorated or imperfectly sterilized solution. Solutions causing headache should promptly be discarded.

TECHNIC

Spinal anesthesia may be employed at all ages and under most conditions, but it should be used with great caution, and with diminished dosage in patients in profound shock, great depression or exhaustion of the spinal centers, or in thoracic lesions abolishing to a large degree the respiratory function.

The nerve segments influenced vary, according to the interspace of the injection, the posture of the patient and the specific gravity of the solution employed, and finally, to the bulk and dosage of the injection. As a rule, the higher the point of injection, the higher the effects produced. One may produce an effect on the high spinal segments by introducing through a lower interspace, after withdrawing cerebrospinal fluid, a large bulk of the anesthetic solution. The withdrawn cerebrospinal fluid may be used to dissolve the drug. A second

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method is to introduce a solution made heavy by the addition of glucose, dextrin, milk-sugar, or other substance, and by a postural manipulation confine the anesthetic to the vicinity of the nerve roots that it is desired to influence. Thus Barker injects a 5 per cent. solution of stovain in a 5 per cent. solution of glucose with the patient on the side, the shoulders and hips being slightly elevated. The patient is then cautiously rolled on the back, the elevation of the shoulders and hips being maintained by suitable pads or boards. The most dependent nerve roots in the lower dorsal region are thus chiefly bathed by the anesthetic.

The method I prefer is to inject through one of the lower dorsal or upper lumbar interspaces a small bulk of fluid having a much lower specific gravity than that of the cerebrospinal fluid. This fluid diffuses rather slowly and passes toward the head of the sacrum, according to the postural manipulation of the patient. If, for example, the injection is made through the twelfth dorsal interspace, and the patient sits up after the injection, the solution, which ascends with an approximate rapidity of about 10 c.c. per minute, will usually reach the lower cervical segments in about one minute. The cervical segments will be involved during the second minute, and if the patient sits up over two minutes, some involvement of the cranial nerves may occur. As the fluid becomes somewhat diluted in its ascent, a larger dose and, therefore, a more prolonged effect may be obtained with less danger of high motor paralysis than when the higher point of injection, advocated by Jonnesco, is employed. Anesthesia involving the higher segments is not so certain or so safe as that involving only the segments below the level of the diaphragm, and should not be attempted by the novice. I have employed the solutions given in Table 7.

These solutions are conveniently kept in ampules, each containing 2 c.c. of solution. They should be prepared under aseptic precautions and sterilized by the inter-

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mittent method and at temperatures not above 65 C. (149 F). The dose, for the adult, of each solution, is from 1 to 1.5 c.c., the larger dose being employed only for robust adults. Of these solutions that of stovain is the most powerful anesthetic and motor paralyzant, most toxic, most actively hemolytic, and the strongest protoplasmic poison. If not acidulated it is precipitated by the alkaline cerebrospinal fluid. It gives excellent anesthesia. Tropacocain is somewhat less active as an anesthetic, and is considered by some to have fewer untoward

TABLE 7.—SOLUTIONS EMPLOYED IN SPINAL ANESTHESIA

Light Solutions:		
A. Stovain	0.08	gm.
Lactic acid	0.04	c.c.
Absolute alcohol	0.2	c.c.
Distilled water	1.8	c.c.
B. Tropacocain	0.1	gm.
Absolute alcohol	0.2	c.c.
Distilled water	1.8	c.c.
C. Novocain	0.16	gm.
Absolute alcohol	0.2	c.c.
Distilled water	1.8	c.c.
Heavy Solution:		
D. Stovain	0.08	gm.
Lactic acid	0.04	c.c.
Milk-sugar	0.10	gm.
Distilled water, to make	2.	c.c.

effects. I have found, however, that each anesthetic when in solution may show variations in analgesic power and in toxic action, possibly due to imperfect sterility, to by-products not eliminated in the manufacture, or as a result of the decomposing effects of heat. Novocain is much weaker than stovain, but is not precipitated by cerebrospinal fluid, and even in a 10 per cent. solution is not actively hemolytic. The clinical efficacy and clinical toxicity of novocain I would estimate as about one-half that of stovain. The loss of epicritic sense is less under novocain. At present I employ solution A. Solution D is used in the rarer instances in which it is desired to keep the head elevated during the operation. Solutions extemporized from powders or tablets I have abandoned for fear of infection. Except to alter the specific gravity there is no advantage in adding epinephrin, strychnin,

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glucose, gelatin or similar substances in the anesthetic solution. The repeated production of spinal anesthesia in the same person is apparently no more harmful than a single injection. My experience indicates that if spinal anesthesia is not properly employed by one possessing sufficient clinical skill, it may have a large mortality. It should not be employed by those who have not developed trustworthy aseptic technic or who have not carefully mastered the physiology of the method.*

TREATMENT OF COMPLICATIONS

The patient, under spinal anesthesia, should be as carefully watched as though ether were being given. In high spinal anesthesia a wisp of cotton should be fastened to the tip of the nose to indicate the frequency and amplitude of the respiratory air-currents. If the respirations become weak a full dose of strychnin and caffein is given by hypodermic injection. If they cease, artificial respiration is most conveniently carried out by rhythmic pressure of the arms on the chest, as an assistant holds the tongue and lower jaw forward. In this emergency the wisp of cotton is most valuable as an indicator of the efficiency of the artificial respiration. The artificial respiration must be continued until conductivity is resumed in the phrenics. Then the patient, who may have been pulseless for five, fifteen or even thirty minutes, with the pallor and relaxation of death, and with the heart-beats so slow and feeble as scarcely to be heard in the excitement of the occasion, awakens as though miraculously resurrected. Spinal asphyxia should not occur in patients in fair physical condition, but as spinal anesthesia is often used recklessly and in a desperate effort to relieve some nearly moribund condition, the value of persistent artificial respiration, oxygen and especially the most powerful of circulatory stimulants, the progressive intravenous injection of

* For untoward effects see: Babcock, The Danger and Disadvantages of Spinal Anesthesia, Proceedings of American Therapeutic Society, 1913.

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epinephrin should be emphasized. It is wise to anticipate threatened cardiac failure by the injection, which should be interrupted as soon as the heart begins to respond.

APPARATUS

I prefer a glass syringe of the Luer type. The syringe should be graduated to 2 c.c. with divisions of 0.1 c.c. The needle should be of iridium-platinum, 7.5 cm. in length, and about 0.1 cm. in thickness. It should be provided with a well-fitting stylet that the lumen may not become clogged in the introduction. The point should be very sharp and very oblique so that the length of the beveled point is only about 0.2 cm. The syringe and needle should be boiled in pure water for fifteen minutes just before using. The addition of an alkali may decompose the anesthetic. The syringe is taken from the water while still hot and filled with the proper dose of anesthetic solution. In this way the solution is warmed by the hot syringe just before introduction.

PREPARATION

To asepticize the back, it is painted with a 5 per cent. tincture of iodin before the patient is brought to the operating-room. As the patient sits on the table this is washed off with alcohol. Should the patient be very nervous, should the operation involve the upper half of the body, or it be desired to render the patient partly oblivious to the procedure, one hour before the operation 1/6 grain of morphin sulphate with 1/100 grain of scopolamin (hydrobromid) or 1/150 grain of atropin sulphate is given hypodermically. Twenty minutes later, if the effect is insufficient the injection is repeated, and in some instances a third hypodermic is desirable. Scopolamin is, as a rule, undesirable, in persons under 25 or 30 years of age. The narcotic injections are to be avoided, or are to be used with great caution and in small dosage, in those patients with marked respiratory depression, grave renal disease or marked toxemia.

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The injection may be made with the patient lying on the side or sitting on the operating-table. To avoid undesirable diffusion of the solution the injection should be made immediately before the operation and preferably on the operating-table. With the patient on the side, the head should be well flexed on the chest, the thighs on the abdomen so as to arch the back and separate the spinous recesses; the patient being so arranged that the spine is not rotated. The interspace is located by a towel, the edge of which when placed on the iliac crests will cross the fourth lumbar spine or interspace; or the interspace may be located by selecting the interspace opposite the angle formed by the last rib and the erector spinae muscle; this is the first lumbar. The injection should be made about opposite the upper level of the field of operation, that is, through the twelfth dorsal or first lumbar interspace for upper abdominal work, and the second lumbar interspace for operations on the lower abdomen or legs. The needle should be entered close to the midline about the center of the interspace and at right angles to the surface of the body, and it should be introduced until the resistance of the ligamentum subflavum is felt. In the athletic this may have an almost cartilaginous consistency, and the sensation imparted usually indicates that the proper direction of the needle is being maintained. If the needle encounters only loose, non-resistant tissue it is probable that it has deviated too far to the side, and it should be withdrawn and reintroduced with more accurate orientation. The stylet is now withdrawn, and the needle is cautiously pushed forward with short quick strokes a few millimeters at a time. The loss of resistance as the needle enters the tissue about the dura is noted, and then the slight resistance accompanied by a perceptible and sometimes audible snap as the tense dura is punctured. The needle is cautiously rotated to make sure that the point is entirely within the cavity of the arachnoid. Cerebrospinal fluid should now drop from the needle; if it does not the

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lumen of the needle should be cleared by the use of the stylet, or the needle should be so adjusted that the fluid will run freely; satisfactory analgesia need not be expected. The usual errors are to incline the needle upward or laterally in the introduction. The quantity of cerebrospinal fluid permitted to escape should be about that of the solution to be injected. If the needle deviates to the side a nerve root may be touched, producing a lightning-like pain usually radiating down the leg. If this occurs the needle should be immediately withdrawn and reintroduced. Puncture of the cord produces no sensation, and while it is to be avoided, it is relatively harmless. The needle charged with the anesthetic solution is affixed to the syringe and free communication with the arachnoid again proved by gently withdrawing the piston. The mixture is now cautiously injected and the needle quickly withdrawn. Apart from placing a sterile towel on the patient the point of puncture requires no dressing. If a light anesthetic solution be used the head and shoulders of the patient must instantly be lowered and maintained below the level of the dorsolumbar region for half an hour after the injection. If a heavy solution be employed the shoulders and head must be kept elevated for a corresponding period of time. Improper movement of the patient and lack of these precautions are responsible for many of the accidents of spinal anesthesis. Nausea, pallor or marked lowering of pulse tension usually indicates that the anesthetic is reaching too high a level and the position of the patient should be further modified to keep the anesthetic solution in the lower part of the spinal canal. The analgesia should develop within two or three minutes. To avoid suggestion, the patient should never be asked as to sensations of pain but the analgesia determined by watching the face as the skin is pinched. If no analgesia is present in six minutes, the injection should be repeated, using the same dosage, and perhaps selecting another interspace. Lack of anesthesia may follow from the use of imperfect

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solutions, failure to introduce the needle properly, and leakage of the solution outside of the arachnoid. In one kyphotic dwarf we failed to enter the spinal canal. In two patients we entered the bony canal but obtained no cerebrospinal fluid and no very obvious analgesia. The analgesia gradually disappears without unpleasant sensation, from above downward in from forty-five to ninety minutes. If not contra-indicated by the operation, sips of water or bits of ice may be administered while the patient is on the operating-table. If the analgesia is inefficient and too transient there is no objection to the associated administration of ether.

CONCLUSIONS

Spinal anesthesia is not a universal anesthetic, although it produces the greatest degree of muscle relaxation with the least protoplasmic disturbance. Even if skilfully administered it is probably more dangerous than a transient and light narcosis under ether or nitrous oxid-oxygen, but safer than a prolonged narcosis with complete relaxation under ether or nitrous oxid-oxygen.

Spinal anesthesia causes an earlier and more marked fall in blood-pressure than other anesthetics, with a slowing and weakening of the heart action, and should therefore be used with caution or avoided in conditions of marked hypotension of the circulatory system.

In certain cases in which alarming symptoms follow the inhalation of ether, spinal anesthesia may be used with success. Spinal anesthesia requires a more highly developed technic and a greater degree of watchful supervision than does the use of ether.

Certain sequelae such as headache and abducens palsy indicate that faulty solutions have been injected; late spinal cord degenerations probably do not occur in man; but various cord and nerve lesions may be simulated in the neurotic or hysteric and attributed to the injection.

In abdominal surgery it may be selected when there is an acute pulmonary, severe cardiac, vascular or renal disease, especially when associated with a high blood-

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pressure. In conditions of acute peritoneal sepsis it is valuable. Against spastic or paralytic ileus it is a most potent agent and its use will often render operative intervention needless.

In malignant disease and for operations on large tumors, while not free from danger, it is at times safer than ether. It does not eliminate the danger of cardiac failure in operations for uterine fibroids.

In obstetrics it facilitates operative delivery, lessens hemorrhage and reduces cardiac and pulmonary strain. In pulmonary tuberculosis it largely relieves the patient of the great danger of labor, the accentuation of the disease. In heart disease it relieves the patient of any strain on the heart tending to decompensation. For operative delivery, during eclampsia it is especially desirable, giving relaxation and lowered blood-pressure without interference with elimination. In extra-uterine pregnancy it is efficient. Spinal anesthesia is relatively safer in the young and robust than in the enfeebled and toxic.

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ABSTRACT OF DISCUSSION

ON PAPERS OF DRS. GELLHORN AND BABCOCK

DR. A. E. HERTZLER, Kansas City, Mo.: First, I wish to criticize Dr. Gellhorn's method of preparation of the patient. My experience is that the less you say to the patient the better. I should think that plugging the ears with cotton would excite rather than allay apprehension. My practice is to ask the patient whether local or general anesthesia is desired. When local anesthesia is selected I take the patient into my confidence and state the stages of the operation offering the greatest difficulties, and keep her informed as to the progress of the operation. The question of local anesthesia is largely one of industry on the part of the operator. Every operation can be done under local anesthesia if the operator has sufficient industry to carry out the procedure.

I desire to emphasize the point made by Dr. Babcock on the need of differentiation between the kinds of sensation that the patient has. It may be a sensation of touch and the operator may think it is a complaint of pain. Only by keeping in touch with the patient by questioning her can this

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point be determined. Restlessness on the part of the patient is often due to the operator's elbow resting on the patient's chest in abdominal work, or perhaps to the fact that some instrument is allowed to press on the region of hyperesthesia.

Dr. Fred J. Taussig, St. Louis: The work that is being done in the large clinics abroad and in this country will before long give us the exact indications and contra-indications for spinal anesthesia. Contrary to Dr. Babcock's views, I believe that in certain cases of myocardial disease I have had better results from spinal anesthesia than from any form of inhalation anesthesia. In the field of the radical abdominal operation for uterine cancer spinal anesthesia seems to be especially valuable. Any one who has operated on a considerable number of patients with this disease, doing the complete operation, knows what a severe strain it is on the individual. A very considerable reduction of about 30 per cent. in the primary mortality has been brought about by several operators with large experience, since in all of their operations they used spinal anesthesia in place of a general inhalation anesthesia.

I have encountered numerous failures when I have attempted to use the infiltration anesthesia spoken of by Dr. Gellhorn in a cervix that was still hard, as in cases of dysmenorrhea in multiparas in which dilatation and curettage were indicated. Here my percentage of failures was very great. In cases of recent abortion, however, with retained placental tissue or with hypertrophied endometrium, we can readily substitute infiltration anesthesia for general anesthesia. I have met practically no failures and believe with Dr. Gellhorn that recent abortion cases are much less liable to hemorrhage when such an anesthetic is used than when a general anesthetic is employed.

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IS MEMBRANOUS DYSMENORRHEA CAUSED BY ENDOMETRITIS

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In this paper I shall use the term "menstrual membrane" instead of membranous dysmenorrhea because we are interested in all the membranes passed during the menstrual period, and since not all are accompanied by pain, the term "membranous dysmenorrhea" cannot cover them all. I shall use the term "membranous dysmenorrhea" only when I wish to convey the idea of a membrane passed with pain. Before taking up the question of the relation of the menstrual membrane to endometritis, it is essential to consider the histology of the endometrium.

HISTOLOGY OF ENDOMETRIUM

The description of the endometrium as given by the anatomists is not uniform. In the old description the endometrium was considered as a definite and unchangeable structure. The picture of the endometrium most commonly met was considered to be the normal one and any deviation from it was looked on as pathologic. Milnes Marshall[1] and Heape,[2] independently of each other, reported a classification of the endometrial changes during the menstrual cycle and thus gave us a better understanding of the endometrial structure. They divided the cycle of twenty-eight days into four periods: The period of construction (about five days), the period

1. Marshall, Milnes: Vertebrate Embryology, London, 1893.
2. Heape, M. A.: The Menstruation of Semnopithecus Entellus, University, Cambridge (Balfour Student), Proc. Roy. Soc., 1893, liv.

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of destruction (about four days), the period of regeneration (about seven days), the period of quiescence (about twelve days), and described the well-defined changes normally noticeable in the endometrium in each of these different stages. They thus widened the range of the endometrial changes within the physiologic limits and gave us a more accurate description of the endometrium. My description will be based on this classification, but for the purpose of this paper it will be sufficient to describe the endometrium during the quiescent stage and then give its changes during the construction (premenstrual) and destruction (menstrual) stages.

THE ENDOMETRIUM IN THE QUIESCENT STAGE

During the quiescent stage, the epithelial cells lining the surface of the mucosa and glands show considerable differences in their shape, size and nuclei. (The superficial epithelial cells are more cuboidal and somewhat smaller than the glandular ones).

The glands during the quiescent stage appear straight or slightly tortuous and are situated in regular and almost parallel rows. Their distance from each other is given by Winters[3] as from two to two and a half transverse diameters of a gland and by Gebhard[4] as from four to five. The size of the glandular lumen is given by Winter as from a half to one cell in width. Each gland is surrounded by a network of spindle-shaped connective-tissue elements, and outside of it by the stroma. (The same spindle-shaped cells are noticed in the neighborhood of vessels and in the deeper layers of the mucous membrane.)

The stroma during this stage appears to be a soft, somewhat mobile protoplasmic mass, imperfectly differentiated into cells. These cells anastomose freely with one another by means of protoplasmic processes closing in

3. Winter, George, and Ruge, C.: Text-Book of Gynecologic Diagnosis, edited by John G. Clark.
4. Gebhard: Referred to by Hitchman, F., and Adler, L.: Die Lehre von der Endometritis, Ztschr. f. Geburtsh. u. Gynäk., 1907, vol. xl.

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the small lymph cavities. They present many and varying alterations in shape, and can readily be displaced by fluid or blood (James Young[5]). At its uppermost layer the stroma cells are arranged parallel to the surface, forming a kind of basement membrane. During this stage there is no mitosis. The blood-supply of the superficial portion of the mucosa consists of capillaries running parallel to the surface epithelium without any specialized supporting coats; James Young[5] and Heape[2] consider the intima and the media of the vessels as consisting of the ordinary flattened cells, and the capillaries as simple blood-tracks through the protoplasmic mass.

THE PREMENSTRUAL OR CONSTRUCTIVE STAGE

During the constructive stage there gradually develops a pronounced serous infiltration of the upper layer of the mucosa. This infiltration or edema has been recognized by Leopold,[6] Westpholen,[7] Young,[5] Hitchman[8] and Meerdervoort.[9] It is ascribed by Young to changes in the stroma cells associated with the liberation of a crystalloidal element. "This crystalloidal element brings about an osmotic pressure discrepancy between the protoplasm of the stroma and the blood in the vessels, to readjust which an outflow of fluid takes place from the lumen of the vessels into the intima and stroma cells." As a result of this process, the intercellular spaces become saturated with the fluid transuded from the vessels, and the perinuclear protoplasm of the stroma cells becomes transformed into a number of fluid spaces bounded by the displaced and thinned-out cytoplasm. The borders of these swollen cells according to Westpholen become indistinct and their nuclei paler, rounder and more cen-

5. Young, James: The Structure of the Stroma of Endometrium and Its Bearing on the Menstrual Changes, Brit. Med. Jour., Oct. 22, 1910.
6. Leopold: Membranous Dysmenorrhea, Arch. f. Gynäk., June, 1876.
7. Westpholen: Referred to by Marshall, Milnes: Vertebrate Embryology, London, 1893.
8. Hitchman, F., and Adler, K.: Die Lehre von der Endometritis, Ztschr. f. Geburtsh. u. Gynäk., 1907, vol. xl.
9. Meerdervoort: Die normale and menstruirende Gebarmütterschleimhaut, Inaug. Dissert., Freiburg, 1895.

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tral.[7] "It is very possible," says Young,[8] "that the network of previous writers in reality corresponds to these spaces in the protoplasm enclosing the fluid actively imbibed." In addition to these changes in the stroma cells themselves, round-cell infiltration and capillary congestion constitute a characteristic feature of the stroma during this stage.

The changes in the glands are also characteristic. They assume a more tortuous appearance, they dilate often from ten to twenty times their size and their interspaces become greatly lessened. (Westpholen[7]). The epithelial lining of the glands undergoes edematous changes similar to those seen in the stroma. The cells are somewhat lower, their outline less distinct and their nuclei paler. The walls of the glands show in places clusters of epithelial cells (papillary processes). Their lumina become filled with mucus and in some places also with leukocytes and red cells. These glandular structures are found only in the deep layers of the mucosa. The superficial layer is rather poor in glands. We therefore have normally in the premenstrual stage two layers in the endometrium; the lower or spongy one, and the upper or compact one (Hitchman[8]).

THE DESTRUCTIVE STAGE OF MENSTRUATION

We see then that before the beginning of menstruation the endometrium presents an edematous stroma of almost jelly-like consistence with wide capillary tracks running through it, and that it then consists of two layers, a deep spongy one and a superficial compact one.[10] With the approach of menstruation the arterial congestion leads to the dilatation of the superficial capillary tracts, and under increased vascular pressure and the condition of the intima and stroma described before, an emigration of red cells from the capillary tract takes place. Whether it is a simple mechanical leakage or, as

10. Ruge makes the same division in his description of endometritis glandularis hypertrophica which Hitchman asserts is nothing more than the premenstrual physiologic condition of the endometrium.

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Young suggests, "an active dragging out of the cells" by the same force that determines the edema, is, of course, difficult at present to say. Whatever the force may be, the red cells either enter the stroma, and pushing it aside form lacunae, or they find their way through the edematous stroma into the lumina of the dilated glands. In either way, the blood can reach the uterine cavity; in the first case, through the displaceable stroma and surface epithelium, and in the second case, through the glandular openings.

A point of great importance in connection with our subject is whether any endometrial tissue is carried away with the blood. On this point there are contradictory opinions. Sir J. Williams (in 1877), von Kahlden (in 1889), Wyder (in 1887), and Wendeler, (in 1895), basing conclusions on necropsies (deaths during menstruation) found extensive denudations of the endometrium; Heape,[2] and Wyder and Gelabin,[11] examining menstrual discharges, found in them uterine epithelial cells and shreds of stroma tissue; Westpholen[7] and Lohlein, from studies of curetted material, came to the conclusion that epithelium and stroma are exfoliated to a slight extent; De Sinety, Moricke, W. Williams and Jacob[11] state that the endometrium is not denuded at all; and Gebhard, while not denying any exfoliation of stroma, admits exfoliation of epithelium. Now, contradictory as these observations appear, they meet the view of Meedervoort[9] and Mandl[12] who assert that the extent to which the mucosa is destroyed varies within wide limits in different persons and even in the same persons in different periods of life.

MECHANICAL DENUDATION

How can the denudation be explained? What is the mechanism of the separation of endometrial tissue from a menstruating uterus? To this question different

11. Referred to by Schaeffer, R.: Veit's Handbuch der Gynecologie, iii.
12. Mandl: Beitrag zur Frage des Verhaltens der Uterusmucosa während der menstruation, Arch. f. Gynäk., 1896, iii.

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answers are given; but it is generally ascribed to the extravasation of blood in the spongy layer with a condition present in the compact layer preventing the free outflow of blood through it. The easily displaceable spongy layer offers no resistance, the blood accumulates there and by its pressure displaces and dissects the softened edematous stroma and the dilated edematous glands. The portions of endometrium thus loosened are expelled under the influence of the uterine contractions during menstruations.[13]

THE DESCRIPTION OF MENSTRUAL MEMBRANE

Menstrual membranes vary a great deal in their macroscopic and microscopic appearances. Different pieces of membrane from the same person at the same periods may present strikingly different pictures. I shall not discuss here the macroscopic appearances of the membranes, as it does not come within the scope of my subject; microscopically the membranes show signs of degeneration varying from a mildly hydropic appearance of the cells to a complete coagulation necrosis when it becomes a fibrinous membrane. Some authors do not consider the fibrinous membrane as an exfoliated endometrial membrane, but fibrinous membranes and exfoliated endometrial membranes may pass at one and the same time and a single section made of a menstrual membrane may show the pictures of both. I may therefore justly state that it is impossible to separate the two varieties anatomically, especially if we remember that there are many transitional forms between them, and I shall consider, therefore, the fibrinous casts as a form of menstrual membrane.

The fibrinous membranes consist mostly of fibrin intermingled with blood, round and polymorphonuclear cells.

13. Kollman (Schein, S. A., Zur Anatomy der Endometritis exfoliativa menstrualis nebst Klinischen Anhang, Arch. f. Gynäk., 1906, lxxx) goes a little further. He asserts that the extravasated blood in the deep layer deposits between the separated endometrium and the uterine wall a fibrin which, together with a leukocyte infiltration, gives rise to a membrane analogous to sequestrum formation.

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The membrane may be so degenerated that only by repeated examinations of sections can one find a necrotic outline of glandular and vascular structures. Occasionally, however, in these fibrinous membranes, especially at the area of its separation, endometrial tissue of definite structure may be seen.

The membranes that are not entirely necrotic present such a variety of microscopic pictures that it is hardly possible to describe them all. They may consist chiefly of stroma with glands few and far apart, or they may consist chiefly of glands with but little interglandular tissue. The cells of the stroma may be necrotic, may assume a decidua-like appearance, may be slightly edematous or even normal; they may be thickly set or widely separated by an exudate. The stroma may be studded with red cells, round polynuclear cells, and occasionally with plasma cells. Fibrin is usually found in the stroma and clasmatocytes are not rarely encountered. The glandular tissue presents no less variety in structure. The glands may be small or very much dilated; they may be straight or tortuous; their epithelium may be normal or present different degrees of degeneration; their lumina may be filled only with mucus or may show also accumulations of different cells (red, round polymorphonuclear cells). They may be found completely isolated from the stroma or may be closely surrounded by it. They may lie near and even touch each other or may be widely separated.

A feature noticed by von Franque, Hager and Meyer and described as a "budding" of the interglandular tissue is sometimes met in the membranes. It is a compact mass of stroma cells in which growth is more active and which penetrates through the loose stroma cells in different directions.

In a general way we may state that in the menstrual membrane we see the premenstrual pictures of the upper layer of the endometrium in the different degrees of its degeneration.

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IS THE MEMBRANE A RESULT OF INFLAMMATION?

The present general opinion is that the cause of menstrual membrane is an endometritis (Gottschalk,[14] Leopold,[6] Grechen,[15] Wyder,[16] Morse,[17] Beigel,[18] Kleinwachter,[18] Lohlein,[11] Kustner,[19] A. Martin[20] and Kelly and Noble.[21] But why ascribe the exfoliation of the membrane to the inflammation of the endometrium? Does any one assert that the menstrual membrane is a symptom of endometritis? Is there any clinical and histologic evidence to prove it?

Clinically, there are no intermenstrual symptoms characteristic of passing menstrual membranes, nor are the symptoms of endometritis necessarily present in such cases. Kollman[22] found no such symptoms in twenty-four membranous cases that he examined. On the other hand, membranous dysmenorrhea is not infrequently hereditary (Sireday, Beigel, Tilt, Brouardel, Duplan and Huchard.) and is occasionally associated with the passage of membranes from other organs such as the vagina (Huchar, J. Williams, Guyenot,[22] Hogan[23] and Leopold[6]), and rectum (Cohnstein,[24] Gauthier and Bordier[22]), and even with skin desquamation. Such clinical facts do not speak in favor of the dependence of membranous dysmenorrhea on endometritis.

Nor are there any histologic proofs for such a dependence. Of sixty-two cases of menstrual membranes collected by Cohnstein,[24] forty-two cases, or 68 per cent., showed no disease of the sexual organs. Thomas,

14. Gottschalk: Die Balneotherapie bei Menstruationstörungen; abstr., Med. Klin., Berlin, March, 1910.
15. Grechen, M.: Membranous Dysmenorrhea, Gynäkologische Studien und Erfahrungen, Berlin, 1888.
16. Wyder: Referred to by Mandl (see Footnote 12).
17. Morse, Elizabeth: Membranous Dysmenorrhea, Rep. 191, Johns Hopkins Hosp., February, 1907.
18. Referred to by Schein (see reference in Footnote 13).
19. Kustner, Otto: Lehrbuch der Gynecologie, 1904.
20. Martin, A.: Pathologie und Therapie der Frauenkrankheiten, p. 62.
21. Kelly and Noble: Operative Gynecology and Abdominal Surgery.
22. Referred to by Cohnstein: Ueber vaginitis exfoliativa und dysm. membranacea, Arch. f. Gynäk., Berlin, 1881, vol. xvii.
23. Hogan, G., and Hogan, E. F.: Zur Pathologie and Therapie der Dysmenorrhea Membranacea, Arch. f. Gynäk., 1876, No. 10.
24. Cohnstein: Ueber vaginitis exfoliativa und dysm. membranacea, Arch. f. Gynäk., Berlin, 1881. vol. xvii.

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Mayer, Scanzoni and Solowieff[22] reported cases of membranous dysmenorrhea without evidences of diseased sexual organs. Schaeffer[25] did not find endometritis in the mucosa obtained during the intermenstrual period in such cases. Even Leopold, who is in favor of the inflammatory etiology of the menstrual membranes and approves of the name "endometritis exfoliativa," says,[6] "It is worthy of note that the membranes described as exfoliative endometritis when examined are found to be normal."

Of course there is no reason why an endometritic uterus could not expel a menstrual membrane. There is no reason why intermenstrual curettage of a patient passing menstrual membranes could not show an endometritis, but this does not prove that an endometritis causes the menstrual membranes, for as H. Meyer[26] justly states, "even if the mucous membrane is found to be in a state of chronic inflammation, its findings do not always agree with those of the expelled menstrual membrane."

But does not the menstrual membrane itself present an inflammatory picture? Of course it does; but this picture is found normally in the endometrium at the end of its premenstrual stage. The edema of interglandular stroma, the dilated vessels, the exudate, the round-cell infiltration, the dilatation and proliferation of glands may be and has been considered features of inflammatory processes (an endometritis), but such changes must be considered physiologic in the premenstrual period and, therefore, cannot be considered inflammatory in the menstrual membrane. For if the picture of menstrual membrane could prove an endometritis, then all menstruating uteri have endometritis.

MENSTRUAL MEMBRANES IN MONKEYS

In this connection it is important to call attention to the description of the endometrial changes during the

25. Schaeffer: Veit's Handbuch d. Gynäk., vol. iii.
26. Meyer, H.: Zur pathologischen Anatomie der dysmenorrhea membranacea, Arch. f. Gynäk., 1887.

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four stages of the menstrual cycle in monkeys—*Semnopithecus entellus* and *Macacus rhesus* as given by M. A. Heape,[2] and *Cerocebus cynomolgus,* as given by Van Herwerden.[27] Space will not permit me to quote their description; suffice it to say that it is similar to that of the endometrial changes in the human female. In the monkeys the degenerative stage is always accompanied by the passage of a menstrual membrane. "The uterine epithelium," says Heape, "and the superficial stroma shrivel up and exhibit signs of degeneration, the epithelium ruptures and the blood contained in the lacunae is poured into the uterine cavity. Denudation follows. All the uterine epithelium, a portion of the glands and in some places whole glands and a depth of about one-third of stroma are cast away with the ruptured vessels, red corpuscles and leukocytes. Of these substances, the menstrual clot is formed." A menstrual membrane then always accompanies the menstruation of monkeys. Are we then to attribute this menstrual membrane in monkeys to an inflammation? Have all the monkeys endometritis? If the passage of the menstrual membrane in monkeys must be admitted to be physiologic, why must we consider it in the human female as dependent on endometritis? Is it because it is rare in the human female? But is it rare?

THE FREQUENCY OF MENSTRUAL MEMBRANE

The passage of membranous tissue is a great deal commoner than it is usually supposed. While MacNaughton Jones.[28] Grechen,[15] Stevens,[29] Lockhart[30] and many others consider it a rare form of dysmenorrhea, John Williams, Scazoni, Oscar Frankl,[31] von Franque, E. G.

27. Van Herwerden: The Physiology of Reproduction, p. 96.
28. Jones, H. MacNaughton: Membranous Dysmenorrhea, Practical Manual of Diseases of Women, ed. 9, 1905.
29. Stevens, T. G.: Dysmenorrhea, Clin. Jour., Aug. 11, 1909.
30. Lockhart: Treatment of Dysmenorrhea, Montreal Med. Jour., 1896-1897.
31. Frankl and Scroggs: A Case of Decidual Expulsion Occurring at Each Menstrual Period, Am. Jour. Obst., 1909, lx.

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Herman,[32] Norris[33] and others consider it of very frequent occurrence. If we were in the habit of carefully examining the clots for shreds our idea of the frequency of menstrual membranes would be different. It should be remembered that membranes are most frequently passed as clots; that it is difficult to separate them from clots, and that in case of fibrinous membranes, they are often overlooked even on microscopic examinations. Again, the passage of membranes is not always accompanied by pain, and therefore more membranes are passed than membranous dysmenorrhea would indicate. Within the last three months, I[34] saw and had sectioned in my practice six menstrual membranes.

DYSMENORRHEA WITH THE MENSTRUAL MEMBRANES

Because of the fact that clinically we have opportunities to observe only patients in whom the passage of menstrual membranes is accompanied by severe pain, we become accustomed to the association of the idea of menstrual membranes with that of dysmenorrhea (membranous dysmenorrhea). Now, dysmenorrhea, in general, is common in our women, and if the menstrual membranes are as common as we believe them to be, there can be no reason why dysmenorrhea should not accompany the passage of membrane in a percentage of cases. But the dysmenorrhea accompanying the passage of membrane in such cases may be dependent on conditions other than the passage of membrane itself. C. E. Herman asserts that it is never caused by the membrane *per se*. Patients, like the one of Gibbon's,[35] who sought his advice because the complete uterine cast was larger than the ones painlessly passed by her monthly before, confirm Herman's view. If we can, as we justly believe we can, dissociate the dysmenorrhea from the passage of menstrual membrane, we take away a great deal of its pathologic aspect.

32. Herman, Ernest G.: Dysmenorrhea, Brit. Med. Jour., 1909, i.
33. Norris, C. C., and Barnard, E. P.: Dysmenorrhea in Nulliparous Women without Gross Local Pathologic Lesions, Am. Jour. Obst., 1910, vol. lxi.
34. These cases will be reported in another article.
35. Gibbons, R. A.: A Lecture on Dysmenorrhea, Brit. Med. Jour., 1910.

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IS STERILITY COMMON?

But how about sterility? Is it not commonly met among women passing menstrual membranes? And if it is, does it not suggest the pathologic origin of the menstrual membrane? We surely cannot call normal a condition which interferes with the functions of an organ. To answer this question we must again bear in mind the frequency with which menstrual membranes are encountered. Not only is the great army of women that pass menstrual clots with or without pain fertile, but even in the bad cases commonly recognized as cases of membranous dysmenorrhea, the women are not absolutely sterile. Solowieff, Fordyce Barnes, Thomas,[36] Lohlein,[18] von Franque, Schaeffer, Kleinwachter, Champignon, Henwig and Bordier reported pregnancies in women suffering from membranous dysmenorrhea. Fritsch goes so far as to say that membranous dysmenorrhea not only does not cause sterility but does not even favor abortion. While the percentage of sterility may be high, if only the bad cases of membranous dysmenorrhea that come to the physician's notice are taken into consideration, it would unquestionably be found to be low if we could include in our statistics all the patients who pass menstrual membranes. It should not be forgotten that among the sterile women that we treat, only a small percentage gives a history of expelling menstrual membranes.

From all that has been said before, I feel justified in concluding that the menstrual membrane is commonly encountered, that it is not the result of an inflammatory condition of the endometrium, and that taking its frequency into consideration it is not accompanied by a high percentage of pelvic pathology and sterility.

OVARIAN HORMONES

What causes the difference in size and extent of the exfoliation of the endometrium? May it not depend on

36. Thomas, referred to by Kisch, H.: Das Geschlechtsleben der Weibes, 1904, p. 573.

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the degree of intensity of the active agent of menstruation and possibly also on the degree of sensitiveness of the endometrium to the agent? Our knowledge on this subject is far from complete. It is generally admitted that the stimulus for menstruation is ovarian in origin. Up to date, the part of the ovary which produces this stimulus is not known. The corpus luteum, the connective tissue and, lately, the parovarium (Bucura[37]) have been suggested as the active part in ovarian internal secretion.

The work of Krauer, Halban, Pfleiger, Morris and others suggested the view that as a result of the periodic function of the ovary, a substance is produced which, when carried through the circulation, induces the uterine changes necessary for menstruation and pregnancy. According to A. L. McIlroy[38] and K. I. Korovitsky,[39] these biochemical substances are hormones secreted by the ovaries and carried by the blood to the endometrium, where it sets up by its irritation, such changes as congestion, cell proliferation, edema and even tissue necrosis. It is possible that the degree of intensity of this hormone decides the intensity of the menstrual process; that is, the more active the hormone and the more susceptible the endometrium the more extensive and the more destructive are the uterine changes. If, then, supposing that the hormones are insufficient to call forth in the uterine stroma the necessary amount of crystalloid material for induction of the edema, might not the superficial layer remain insufficiently edematous to allow the blood to break through it? On the other hand, if the hormones are excessive or the mucosa too sensitive to them might they not induce destructive changes in the cells calling out fibrin formation or coagulation necrosis? In either case the blood cannot pass through the hardened mucosa and, accumulating in

37. Bucura, referred to by Biedl, Arthur: Internal Secretory Organs.
38. McIlroy, A. L.: Proc. Roy. Soc. Med. Jour., July, 1912.
39. Korovitsky, K. I.: Ruski Vratch, Oct. 13, 1912.

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the spongy layer, may cause exfoliation of part or the whole of the upper compact layer.

May it not, therefore, be that the normal menstruation, with the slight superficial shedding of epithelium and the exfoliation of endometrial shreds or membranes, are the results of the same normal process, the difference being due to the variable degree of intensiveness of the stimulant action of the hormones?

Jenkin's Building.

ABSTRACT OF DISCUSSION

DR. ROBERT T. FRANK, New York: The main question concerning membranous dysmenorrhea centers on the pathology, because the treatment is largely dependent on that. If it is an inflammatory condition, we must treat it accordingly. If purely an exaggerated physiologic function, we are probably more powerless than in the other case. I agree more or less with Dr. Sanes in the view that in some instances it is congenital. So far as treatment is concerned, in such instances we are powerless, although lately I have seen one case in which the nasal treatment has been followed by the disappearance of the dysmenorrheic membrane. How the cauterization of the nasal membrane acts on the membranous dysmenorrhea I do not know, and we are no nearer solving the question of the cause of the condition.

DR. HENRY O. MARCY, Boston: I am surprised that the great work of Prof. G. B. Ercolarri of Bologna, Italy, on "The Reproductive Processes in Man and Animals," has not been referred to. This I translated; the last edition in 1884. The utricula glands of the uterus perform a special normal function. Menstruation is putting the house in order for the little tenant, who may never arrive. The woman would not be reproductive were it not for the changes that go on in the shedding to the very base of the utricular glands. This new endometrium is the most important factor in reproduction. In endometritis we have the most favorable condition for bacterial development and pathology of the reproductive organs.

DR. G. GELLHORN, St. Louis: On microscopic examination, the casts of membranous dysmenorrhea hardly ever show inflammatory changes. For this reason, curettage, as a rule, is of no avail, and the condition is, indeed, usually incurable by the ordinary means. My studies of syphilis of the uterus make me feel that a certain percentage, at least, of cases of membranous dysmenorrhea is due to tertiary syphilis. I believe that in all such cases a trial with mercury and potassium iodid should be made before resorting to curettage.

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DR. K. I. SANES, Pittsburgh, Pa.: Hysteria is given by most of the authorities as the most important etiologic factor. Of the six cases of membranous dysmenorrhea that came under my observation, five were hysterical. Syphilis and tuberculosis are mentioned as causes by a great many authors. Inflammation is frequently given as a cause of membranous dysmenorrhea, because the picture of glandular endometritis is found in the premenstrual uterine mucosa in patients with membranous dysmenorrhea. I do not know how much reliance is to be placed on Hitchman's statement, but, after extensive study of endometritis, he came to the conclusion that so-called glandular endometritis is a normal condition of the uterine mucosa in the premenstrual stage. In patients curetted a few days before menstruation, we obtained this glandular structure. In this connection it may be interesting to note that in a case of membranous dysmenorrhea in which we curetted two days before menstruation the scrapings showed stroma and the glands completely degenerated, thus resembling the fibrinous membrane the patient had been passing monthly.

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LIST OF FELLOWS OF THE SECTION ON OBSTETRICS, GYNECOLOGY AND ABDOMINAL SURGERY

The following is a list of Fellows of the American Medical Association who, at one or more of the last five sessions, have registered in the Section on Obstetrics, Gynecology and Abdominal Surgery. The figure following the name indicates the year in which the member registered (9 indicating 1909, 0, 1910, etc.). Any errors which may have occurred should be brought to the attention of the secretary of the Section.

Abbe, Truman, Stoneleigh Court, Washington, D. C. 9.
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Bland, Curtis, Preston, Idaho. 9.
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Collins, J. L., Sheffield, Ia. 3.
Comfort, Clifford V. C., 512 Mercantile Bldg., Rochester, N. Y. 2.
Commiskey, Leo J. J., 189 6th Ave., Brooklyn. 2.
Conaway, W. P., 1723 Pacific Ave., Atlantic City, N. J. 4, 9, 2, 3.
Congdon, Charles E., 859 Humboldt St., Buffalo. 2.
Conner, A. L., 7056 Main St., Philadelphia. 7, 2.
Conway, H. P., Spring Valley, Wis. 3.
Cook, Chas. P., 911 E. Spring St., New Albany, Ind. 0.
Coon, W. F., Caney, Kan. 3.
Cooper, St. Cloud, Fort Smith, Ark. 0.
Copeland, M. A., 721 S. 20th St., Birmingham, Ala. 0.
Cory, W. M., Waterville, Minn. 3.
Crowley, Daniel F., 208 Flynn Bldg., Des Moines, Ia. 3.
Cosgrave, Millicent, 350 Post St., San Francisco. 1.
Cowles, J. E., 716 Amer. Bank Bldg., Los Angeles, Cal. 1.
Craig, N. S., Jennings, La. 8, 3.
Crain, B. F., Carterville, Ill. 0.
Creamer, Michael S., 501 Homer Laughlin Blk., Los Angeles, Cal. 1.
Cregar, P. B., Plainfield, N. J. 9.
Crossen, H. S., 5423 Bartmer Ave., St. Louis. 9, 0.
Crotty, Nora, 75 The Groton, Cincinnati. 2.
Culbertson, Carey, 3547 Adams St., Chicago. 8, 0.
Culbertson, Emma B., 33 Newbury St., Boston, Mass. 3.
Cullen, T. S., 3 W. Preston St., Baltimore. 4, 6, 7, 8, 3.
Cunningham, J. N., Stanley, Wis. 8.
Curtis, A. N., 4205 Virginia Ave., St. Louis. 0.

Da Costa, J. C., 264 S. 15th St., Philadelphia. 4, 9.
Dail, A. W., L. Box 111, Cement, Okla. 0.
Dannreuther, Walter T., 2030 Broadway, New York City. 2.
Darling, Chas. B., 50 Townsend St., Boston. 6, 1.
Darnall, W. E., 1704 Pacific Ave., Atlantic City. 6, 9, 2.
Davenport, James Henry, 210 Benefit St., Providence. 2.
Davies, Wm. Rowland, 221 S. Main Ave., Scranton, Pa. 3.
Davis, Albert B., 511 Cooper St., Camden, N. J. 2.
Davis, D. W., Wellston, Ohio. 9.
Davis, E. C., 25 E. Linden St., Atlanta, Ga. 0, 2, 3.
Davis, E. W., 142 Washington Ave., Seymour, Conn. 9.
Davis, Edward P., 250 S. 21st St., Philadelphia. 6, 7, 2.
Davis, Ella M., 188 Chestnut St., Holyoke, Mass. 9.
Davis, Fannie, 801 Arch St., Pittsburgh. 9.
Davis, J. C., 19 Cumberland St., Rochester, N. Y. 4, 9, 2.
Davis, John D. S., 2031 G. Ave., Birmingham, Ala. 6, 7, 0, 2.
Davis, W. J., 229 Barney St., Wilkes-Barre, Pa. 2.
Day, Mary Gage, Kingston-on-Hudson, N. Y. 9.

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Deal, John C., 5325 Haverford Ave., Philadelphia. 9.
Deichmann, O. H., 411 E. Capitol Ave., Springfield, Ill. 0.
DeLee, J. B., 5028 Ellis Ave., Chicago. 8, 2, 3.
Denney, Jos. C., Clyde Park, Mont. 3.
Dennis, Mary E., 1217 Trenton St., Los Angeles, Cal. 1.
DeVenney, J. C., 1115 N. 2d St., Harrisburg, Pa. 2.
Dickinson, Robert L., 168 Clinton St., Brooklyn. 2.
Diez, M. Luise, 5733 Spruce St., Philadelphia. 2.
Dilliard, Benjamin F., East Bangor, Pa. 2.
Disen, Chas. F., 2600 E. 22nd St., Minneapolis, Minn. 3.
Doane, Philip S., 1427 N. State St., Chicago. 0.
Dodge, Roy A., 446 Brandeis Bldg., Omaha, Neb. 3.
Doederlein, T. J., 5713 Kenmore Ave., Chicago. 0.
Donoghue, Francis D., 864 Beacon St., Boston. 5, 6, 7, 9, 2.
Dorland, W. A. N., 1410 W. Jackson Blvd., Chicago. 4, 9.
Dorsett, E. L., 410 Woll Bldg., St. Louis. 8, 0.
Dorsett, W. B., 5070 Washington Blvd., St. Louis. 4, 5, 6, 7, 8, 9, 0, 1, 2, 3.
Dorsey, F. B., 11 N St., Keokuk, Iowa. 6, 8, 0.
Downs, A. J., 303 Johnson Blk., Los Angeles, Cal. 0, 1.
Doyle, O. B., Powell Bldg., Fresno, Cal. 1.
Drechler, Louis, 2701 Blair Ave., St. Louis. 0.
Dubell, J. E., Columbus, N. J. 9.
Dugdale, R. B., 127 S. Lafayette St., South Bend, Ind. 1.
Duncan, H. A., 2721 W. Lehigh Ave., Philadelphia. 9, 2.
Dunlap, Elbert, Wilson Bldg., Dallas, Texas. 0.
Dunn, J. E., Stratford, S. D. 3.
Dunsmoor, John M., 218 Stimson Bldg., Los Angeles, Cal. 1.
Dunsmoor, Nannie C., 330 Laughlin Bldg., Los Angeles, Cal. 1.
Durrie, Anna B., % Colo. Sanit., Boulder, Colo. 1.
Dwire, Francis B., Gardena, Cal. 1.

Eastman, T. B., 308 Pennway Bldg., Indianapolis. 5, 8, 3.
Eaton, Alvin R., Jr., 1157 E. Jersey St., Elizabeth, N. J. 2.
Echols, C. M., 800 Majestic Bldg., Milwaukee, Wis. 2, 3.
Edwards, Thos. C., 224½ Main St., Salinas, Cal. 1.
Ehrenfest, Hugo, 4333 McPherson Ave., St. Louis. 0.
Eidmann, Walter P., 3160 Morganford Rd., St. Louis. 0.
Elkin, W. S., 27 Luckie St., Atlanta, Ga. 2.
Ellis, Wm. Clyde, 115 W. Monroe St., Phoenix, Ariz. 1.
Elsey, J. R., Glenwood, Minn. 3.
Eltun, T. J., Velva, N. D. 3.
English, C. H., Ft. Wayne, Ind. 8, 2.
Erck, Theo. A., 251 S. 13th St., Philadelphia. 2.
Eshleman, L. H., 2923 S. Washington St., Marion, Ind. 3.
Estel, G. A., Jacob, Ill. 0.
Ewer, Edward N., 176 Santa Rosa Ave., Oakland, Cal. 5, 1.

Fair, Robt. P., 481 Beacon St., Boston. 2.
Fairchild, F. D., 4521 Central Ave., Los Angeles, Cal. 1.
Feeley, Matilda A., 1700 Sutter St., San Francisco. 1.
Feidt, Wilson Wellington, 1028 Andrus Bldg., Minneapolis, Minn. 3.
Fifield, Emily W., 431 Syndicate Blk., Minneapolis, Minn. 3.
Findley, Palmer, 3602 Lincoln Blvd., Omaha. 1, 2.
Finley, C. S., 104 East 40th St., New York City. 2, 3.
Fisher, John M., 222 S. 15th St., Philadelphia. 6, 7, 9.
Fisher, W. H., 416 Colton Bldg., Toledo, Ohio. 8, 3.
Fithian, J. W., 608 Broadway, Camden, N. J. 6, 9, 2.
Fjelstad, C. A., Glenwood, Minn. 3.
Fletcher, Arthur J., Homer, Ill. 3.
Floyd, J. C. M., Steubenville, O. 3.
Fort, R. E., 209 N. Vine St., Nashville, Tenn. 6, 9.
Fortun, O. J., Mayville, N. D. 3.
Foster, C. S., 5745 Ellsworth St., Pittsburgh. 2, 3.
Foulkrod, Collin, 4022 Chestnut St., Philadelphia. 0, 2.
Frame, C. N., Ewing, Mo. 0.
Frank, Robt. T., Hanover, 83rd St. and Park Ave., New York City. 3.
Franklin, Geo. W., Jefferson, Ia. 3.
Freeburg, H. M., Watertown, S. D. 8, 3.
Freeman, J. P., Glenville, Minn. 3.
Freeman, T. O., Mattoon, Ill. 0.
French, Charles E., 701 Phelan Bldg., San Francisco. 1.
Froehlich, Herman W., % Stevenson Iron Mining Co., Crosby, Minn. 0.
Fry, H. D., 1929 19th St. N.W., Washington, D. C. 4, 6, 7, 8, 9, 10.
Fuchs, Walter H., 3202 Lafayette Ave., St. Louis. 0.
Fuhrmann, R. H., 3221 California Ave., St. Louis. 0.
Furniss, H. D., 393 W. End Ave., New York City. 9, 2, 3.
Furniss, John N., 602 Lauderdale St., Selma, Ala. 2.

Gage, G. R., 27½ N. Main St. Hutchinson, Kan. 3.

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Gallant, A. Ernest, 70 E. 66th St., New York City. 5, 6, 7, 8, 9.
Gardner, Edwin L., 1011 E. River Road, Minneapolis, Minn. 3.
Gardner, M. N., Greenleaf, Kan. 0.
Gardner, Paul E., New Hampton, Ia. 3.
Gardner, Wm. S., 6 W. Preston St., Baltimore. 4, 6, 9, 0, 2.
Garlick, S. M., 474 State St., Bridgeport, Conn. 2.
Garrabrant, C., 19 N. Penn Ave., Atlantic City, N. J. 6, 9, 3.
Garrison, J. Frank, Oldham, S. D. 3.
Garvin, D. E., 835 12th St., Golden, Colo. 2.
Gatchell, Ella F., Chico, Cal. 1.
Gates, L. M., 802 Muckberry St., Scranton, Pa. 1, 2, 3.
Gayler, W. C., 3862 Olive St., St. Louis. 0.
Gehrung, Eugene C., 15 E. 48th St., New York City. 0.
Gelder, E. E., 623 Jeff Bldg., Peoria, Ill. 2.
Gellhorn, George, 713 Metropolitan Bldg., St. Louis. 8, 0, 3.
Gelpi, Maurice J., Audubon Bldg., New Orleans. 2.
George, Jas. W., 412 Reid Corner, Minneapolis, Minn. 3.
Gerould, T. F., Centralia, Ill. 3.
Gibb, W. Travis, 42 W. 75th St., New York City. 1.
Gibbons, Henry W., 5850 California St., San Francisco. 1.
Gibbs, Roy S., 425 4th St., San Bernardino, Cal. 1.
Gilbert, W. H., Evansville, Ind. 0.
Gilliam, D. Todd, 333 E. State St., Columbus, Ohio. 7, 8, 0.
Gillmore, Robert T., 1230 E. 63d St., Chicago. 5, 7, 0.
Girvin, John H., 2121 Walnut St., Philadelphia. 4, 9.
Glaser, M. J., 1825 S. Jefferson Ave., St. Louis. 0.
Glasgow, Frank A., 3894 Washington Ave., St. Louis. 0.
Gledhill, Henry R., Jerseyville, Ill. 6, 0.
Gockley, A. S., Carroll, Iowa. 2.
Goffe, J. Riddle, 616 Madison Ave., New York City. 4, 5, 6, 7, 0, 2, 3.
Golden, W. W., Elkins, W. Va. 9.
Goldspohn, A., 2118 Cleveland Ave., Chicago. 4, 5, 6, 7, 0, 1, 2, 3.
Goodrich, Wm. A., 6 Abbott Ave., Waterbury, Conn. 9.
Goss, E. L., Carrington, N. D. 8.
Grad, Herman, 159 W. 120th St., New York City. 6, 7, 9, 2.
Gragg, Vincent J., Clanton, Ala. 3.
Graves, Wm. P., 244 Marlborough St., Boston. 2.
Greene, Mary T., Castile, N. Y. 9.
Greene, Thos. F., 322 Warren St., Boston. 9, 2.
Greenfield, B. H., 205 S. Orange Ave., Newark, N. J. 2.
Greer, Bertha A., Lamoni, Iowa. 0, 1.
Gronwold, Arthur C., Fort Ransom, N. D. 3.
Guinn, J. H., Arkansas City, Kan. 1.
Gunderson, Harley J., 1422 W. Lake St., Minneapolis, Minn. 3.
Guthrie, J. R., 1005 Locust St., Dubuque, Iowa. 4, 5, 1, 3.

Haagensen, E. C., Hillsboro, N. D. 3.
Hablutzel, C. E., 105, 11th St., San Jose, Cal. 1.
Hackett, Emma C., 41 Central Park W., New York City. 8, 9.
Haight, G. G., Audubon, Minn. 3.
Haley, James F., Midland, Tex. 1.
Hall, C. Lester, 523 Bryant Bldg., Kansas City, Mo. 4, 6, 0, 3.
Hall, John M., 799 Ocean Ave., Brooklyn, N. Y. 2.
Hall, R. B., Berkshire Bldg., Cincinnati. 9, 2, 3.
Hamilton, B. C., Jefferson, Ia. 3.
Hamilton, S. S., 300 W. Mahoning St., Punxsutawney, Pa. 9.
Hammond, Frank C., 3338 N. Broad St., Philadelphia. 7, 9.
Hammond, Jas. Felton, 334 Lowry Bldg., St. Paul, Minn. 3.
Hanna, M. A., 515 Commerce Bldg., Kansas City, Mo. 0.
Hanser, H. A., 3651 Delmar Blvd., St. Louis. 0.
Hanson, Geo. C., Charlson, N. D. 3.
Harbert, G. E., Beverly, N. J. 2.
Hargrave, E. T., 816 Redgath Ave., Norfolk, Va. 6, 0.
Harman, Wm. J., 1162 E. State St., Trenton, N. J. 2.
Harmann, M. F., 3441 N. 9th St., St. Louis. 0.
Harpster, C. M., 705 Madison Ave., Toledo, Ohio. 8.
Harris, Philander A., 453 Park Ave., Paterson, N. J. 6, 7, 9, 3.
Hart, Robt. S., Hazel, S. D. 3.
Harter, Isaac F., Stronghurst, Ill. 1.
Hartman, John V., Findlay, O. 3.
Hartung, Henry, 722 Diversey Parkway, Chicago. 5, 6, 8, 0.
Harvey, E. M., Media, Pa. 9, 2.
Hartwell, D. D., Marion, Ill. 3.
Harvey, E. H., 20 N. Florida Ave., Atlantic City, N. J. 2.
Haskins, Mary G., 270 Woodward Ave., Detroit. 9.
Hayden, A. M., Evansville, Ind. 3.
Hayes, Nellie S., 306 Ferguson Bldg., Los Angeles, Cal. 1.
Heaney, N. Sproat, 1523 E. 66th Pl., Chicago. 3.
Helmark, A. J., Finley, N. D. 3.
Heineberg, Alfred, 1642 Pine St., Philadelphia. 9, 2.
Heinecke, Geo. B., 5634 Georgia Ave., N.W., Washington, D. C. 9, 2.

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Heller, Jacob, 224 Henry St., New York City. 2.
Henry, Clifford E., 715 Donaldson Bldg., Minneapolis, Minn. 3.
Henry, W. O., 610 Brandies Theater Bldg., Omaha, Neb. 2, 3.
Hensel, Chas. N., 223 Moore Bldg., St. Paul, Minn. 3.
Herington, Warner, Green City, Mo. 0.
Hertzler, Arthur E., Halsted, Kan. 1.
Herzog, Geo. K., 133 Geary St., San Francisco. 1.
Heseltine, V. G., Aberdeen Hotel, St. Paul, Minn. 3.
Higgins, C.. W., 2 George St. Providence, R. I. 4, 6, 7, 9, 2.
Hilkowich, A. M., 280 E. Broadway, New York City. 2.
Hill, I. L., 616 Madison Ave., New York City. 9.
Hill, W. B., 507, 39th St., Milwaukee, Wis. 9, 2.
Hinchey, Frank, Humboldt Bldg., St. Louis. 0.
Hipke, G. A., 3021 Cedar St., Milwaukee, Wis. 8, 10.
Hirschfield, Adolph, 1017 Washington Ave., N., Minneapolis, Minn. 3.
Hirschfield, M. S., New Jersey Bldg., Duluth, Minn. 3.
Hobbs, Alice L., 221 W. 11th St., Indianapolis. 8, 1.
Hodgins, Arthur G., 242 Beretania St., Honolulu, Hawaii. 9.
Hoffman, C. S., Keyser, W. Va., 0, 2.
Hoffmann, Chas. von, 2669 California St., San Francisco. 1.
Holland, S. Z., Daytona Beach, Fla. 0.
Holmes, Rudolph W., 36 E. Elm St., Chicago. 4, 8, 3.
Hollister, J. C., 2735 Bancroft Way, Berkeley, Cal. 1.
Holt, E. E., 1209 N. Grand Ave., St. Louis. 0.
Hopkins, M. J., 3558 Lindell Blvd., St. Louis. 0.
Hornibrook, E., Cherokee, Iowa. 1.
Horsley, J. Shelton, 330 W. Grace St., Richmond, Va. 3.
Houck, Mary P., 816 Main St., La Crosse, Wis. 3.
Howard, Chas. E., Benton, Ky. 0.
Hromadka, A. B., Sawtelle, Cal. 1.
Hubert, R. I., 853 Iglehart Ave., St. Paul, Minn. 3.
Huggins, R. R., 1018 Westinghouse Bldg., Pittsburgh. 0. 2.
Hull, Edw. T., 258 W. 139th St., New York City. 0.
Humphrey, W. R., Tornius Blk., Stillwater, Minn. 3.
Hunner, Guy L., 2305 St. Paul St., Baltimore. 4, 6, 7, 9, 2.
Huson, Florence, 506 Cass Ave., Detroit. 4, 6, 7, 2.
Hutchins, H. T., 374 Marlborough St., Boston. 2.
Hynes, B. M., 1615 S. Grand Ave., St. Louis. 0.

Ill, Edw. J., 1002 Broad St., Newark, N. J. 9, 2.
Ingraham, Clarence B., Jr., 1405 Glenarm St., Denver. 1.
Irwin, John R., 401 N. Tryon St., Charlotte, N. C. 1.
Isaac, J. P., Freeman, S. D. 3.

Jack, Harvey P., 26 Main St., Hornell, N. Y. 4, 6, 7, 8, 9.
Jacob, Louis H., 135 W. Susquehanna Ave., Philadelphia. 9.
Jacobson, Henry, 705 Olive St., St. Louis. 0.
Jacobson, J. H., 239 Michigan St., Toledo. 0, 1, 2, 3.
Jermain, Hubert F., 983, 12th St., Milwaukee, Wis. 3.
Jewell, Robt. T., 538 Con. Realty Bldg., Los Angeles, Cal. 1.
John, J. W., 204½ Main St., Pine Bluff, Ark. 2.
Johnson, Burt C., 1404 Main St., Buffalo, N. Y. 9.
Johnson, Henriette A., 815 E. Lake St., Minneapolis, Minn. 3.
Johnson, H. L. E., 1821 Jefferson Pl., N.W., Washington, D. C. 4, 5, 7, 9, 0, 1, 2, 3.
Johnson, Ray H., 449 Franklin St., Buffalo, N. Y. 7, 2.
Johnson, W. S., 304 Story Bldg., Los Angeles, Cal. 8, 1.
Johnston, J. A., 66 Hollester St., Cincinnati. 5, 6, 0, 1.
Joistad, Arthur H., Fairdale, N. D. 3.
Jolley, Louis B., North Chicago, Ill. 3.
Jones, Thos. E., 145 Susquehanna Ave., Philadelphia. 2.
Jungblut, H. C., Tripoli, Ia. 3.

Kahn, Maurice, 4624 S. Ashland Ave., Chicago. 8, 0.
Kahn, Sol G., 821 Boston Bldg., Salt Lake City, Utah. 2.
Kasten, W. C., Fort Madison, Iowa. 0.
Keehn, G. A., 2702 N. Grand Ave., St. Louis. 0.
Keene, F. E., 116 S. 19th St., Philadelphia. 2.
Keim, Wm. F., 25 Roseville Ave., Newark, N. J. 9.
Keller, Frank J., Sherman and Totowa Ave., Paterson, N. J. 9.
Kellogg, W. C., 203 Seymour St., Syracuse, N. Y. 2.
Kelly, Howard A., 1418 Eutaw Pl., Baltimore. 4, 6, 9.
Kelly, J. W., 403½ S. 6th St., Springfield, Ill. 0.
Kennedy, Bernays, Hume-Mansur Bldg., Indianapolis. 0, 3.
Kennedy, Jane F., 713 Donaldson Bldg., Minneapolis, Minn. 3.
Kennedy, J. W., 1409 Spruce St., Philadelphia. 2.
Kenton, J. R., Raymond, Ill. 0.
Kepler, C. O., 362 Commonwealth Ave., Boston. 0.

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Kerch, H. E., Dundee, Ill. 2.
Kerr, Wm., Randolph, Iowa. 0.
Kerwin, W., 4900 Laclede Ave., St. Louis. 0.
Keyes, J. J., 226, 17th St., Brooklyn. 9.
Kibbe, O. E., Canton, Minn. 3.
Kier, W. F., 3609 Lindell Blvd., St. Louis. 0.
Kimball, A. C., 2700 N. Grand Ave., St. Louis. 0.
Kirkwood, R. C., 6802 South Blvd., Oak Park, Ill. 3.
Kirton, J. R. W., Oseola, Mich. 0.
Kjaerbge, C. B., Forsyth Bldg., Fresno, Cal. 1.
Knipe, N. L., 701 S. 52d St., Philadelphia. 2.
Kosmak, G. W., 23 E. 93d St., New York City. 6, 7, 9.
Kreutzer, C. A., 135 Grand Ave., Milwaukee, Wis. 3.
Krusen, Wilmer, 127 N. 20th St., Philadelphia. 4, 9, 2.
Kurtz, Carl, 1129 S. Alvaro St., Los Angeles, Cal. 1.

La Breck, F. A., Eau Claire, Wis. 3.
Ladinski, L. J., 1289 Madison Ave., New York City. 2.
Lamb, I. H., 2114 18th St., Washington, D. C. 2.
Lancaster, Blake McK., Crosby, N. D. 3.
Langworthy, S. B., Ryan Bldg., Leavenworth, Kan. 8, 3.
Larrabee, F. W., Warren, Me. 1.
Larsen, L. A., Colfax, Wis. 3.
Lattin, Cora B., West Falls, N. Y. 0.
La Vake, Rae T., 413 Pillsbury Bldg., Minneapolis, Minn. 3.
Lawrence, F. F., 328 E. State St., Columbus, Ohio. 4, 5, 6, 7, 0.
Laws, Carl H., 1527 E. Franklin Ave., Minneapolis, Minn. 3.
Lawson, H. W., 1117 Vermont Ave., Washington, D. C. 2.
Lazard, Edmond M., 611 Lissner Bldg., Los Angeles. 1.
Leavitt, Frederick E., Lowry Arcade, St. Paul, Minn. 3.
LeClerc, J. E., Le Sueur, Minn. 8, 3.
Lee, Thos. B., 601 Walnut St., Camden, N. J. 2.
Leof, M. V., 1700 N. Franklin St., Philadelphia. 9, 2.
Leonard, Homer O., 1115 Grand St., Kansas City, Mo. 0.
Le Rosingal, W. J., Rifle, Colo. 3.
Leslie, James F., Mounds, Ill. 0.
Lessig, J. A., Schuylkill Haven, Pa. 9.
Lewis, G. C., Fairbury, Ill. 3.
Lewis, W. E., Seaside, Ore. 5, 1.
Lewis, Will J., 310 California St., Ventura, Cal. 1.
Liell, E. N., 140 W. Monroe St., Jacksonville, Fla. 4, 6, 7, 9.
Lindley, Walter, 1414 S. Hope St., Los Angeles, Cal. 5, 1.
Lindsay, Kate, Sanitarium, Boulder, Colo. 3.
Linklater, Eugene R., 930 W. Ferry St., Buffalo, N. Y. 3.
Litzenberg, J. C., 3137 Park Ave., Minneapolis. 6, 8, 2, 3.
Lockrey, Sarah H., 1520 Vine St., Philadelphia. 4, 8, 9, 2.
Long, Judson H. E., 806, 3d Ave., Moline, Ill. 0.
Longenecker, C. B., 3416 Baring St., Philadelphia. 4, 6, 9, 2.
Loomis, E. E., Janesville, Wis. 6, 1.
Looney, Robt. N., Prescott, Ariz. 1.
Loranger, Philip J., 383 Canton Ave., Detroit, Mich. 3.
Lothrop, Earl P., 153 Delaware Ave., Buffalo, N. Y. 9, 0.
Luburg, L. F., 1822 Girard Ave., Philadelphia. 9, 2.
Luther, F. M., 610 W. 113th St., New York City. 2.
Lyons, J. A., 8 N. State St., Chicago. 8, 3.
MacCarroll, D. R., 2503 S. Broad St., Philadelphia. 2.
MacDonald, Daniel A., 1211 E. Franklin Ave., Minneapolis, Minn. 3.
MacEvitt, John C., 407 Clinton St., Brooklyn. 1, 2, 3.
Macfarlane, Catherine, 5808 Greene St., Philadelphia. 9.
MacKenzie, John R., Carrington, N. D. 3.
McAlexander, R. O., 320 N. Meridian St., Indianapolis. 6, 7, 0.
McCabe, W. M., City Hosp., Nashville, Tenn. 3.
McCallin, A. E., Wisconsin Veterans' Home, Wis. 0.
McCannel, A. J., Minot, N. D. 3.
McCarroll, H. R., Walnut Ridge, Ark. 0.
McCarty, T. L., Dodge City, Kan. 3.
McCoy, John H., 817 Francis St., St. Joseph, Mo. 3.
McCracken, R. W., Union Grove, Wis. 8, 3.
McCullough, A. H., 78 W. Park Ave., Mansfield, O. 3.
McCullough, G. T., Higgins Block, Missoula, Mont. 5, 0.
McCune, M. Virginia, Martinsburg, W. Va. 4, 0.
McDonald, Ellice, 45 E. 42d St., New York City. 7, 9.
McDougald, John Q., 1336 Lombard St., Philadelphia. 2.
McEwen, Mary G., 1703 Chicago Ave., Evanston, Ill. 0, 3.
McGann, Peter J., Augusta, Mo. 0.
McGlinn, John A., 113 S. 20th St., Philadelphia. 9, 2.
McGroarty, John J., Easton, Minn. 3.
McGuire, M. F., 44 E. State St., Montpelier, Vt. 0.
McKee, E. S., 639 W. 7th Ave., Cincinnati. 5, 6, 7, 8, 0.
McKenney, D. C., 1250 Main St., Buffalo, N. Y. 9, 3.
McLean, Mary H., 4339 Delmar Blvd., St. Louis. 0.

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McMahon, J. P., 406 Cudahy Apts., Milwaukee, Wis. 3.
McMenamin, F. J., 131 Main St., Oneonta, N. Y. 9.
McMurray, R. J., 13th and Main Sts., Francisville, Ill. 0.
McMurtry, L. S., 5 Ormsby Pl., Louisville, Ky. 4, 5, 6, 7, 8, 0, 2, 3.
McNeile, Lyle G., 630 Auditorium Bldg., Los Angeles, Cal. 1.
McNutt, Julia G., R.F.D., W. Albany, N. Y. 0.
McNutt, Sarah J., 265 Lexington Ave., New York City. 9, 0, 2.
McParlan, John P., 1039 Madison Ave., New York City. 9.
McPherson, Ross, 20 W. 50th St., New York City. 8, 9, 0, 2, 3.
Maertz, Charles, 1405 Elm St., Cincinnati. 9.
Magee, Chester L., El Monte, Cal. 1.
Magee, M. D'Arcy, 1623 Connecticut Ave., Washington, D. C. 3.
Magee, W. G., Granite Blk., Watertown, S. D. 3.
Magill, Wm. H., 221 Thayer St., Providence, R. I. 2.
Maison, Robert S., Chester, Pa. 2.
Mallett, G. H., 244 W. 73d St., New York City. 9, 2.
Manton, W. P., 32 W. Adams Ave., Detroit. 4, 5, 6, 7, 8, 9, 0, 2.
March, E. J., 322 S. Cleveland Ave., Canton, Ohio. 4, 9, 0, 1, 2, 3.
Marcy, Henry O., 180 Commonwealth Ave., Boston. 4, 6, 7, 8, 9, 0, 2, 3.
Marken, Martin H., Boyd, Minn. 3.
Markoe, Jas. W., 20 W. 50th St., New York City. 2, 3.
Marshall, Clara, 258 S. 16th St., Philadelphia. 0, 1.
Martin, Elizabeth L., 329 S. Dallas Ave., Pittsburgh, Pa. 4, 9.
Martin, F. H., 31 N. State St., Chicago. 6, 1, 3.
Martindale, Joseph W., 2303 Federal St., Camden, N. J. 7, 9.
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Marx, Ella, 4161 Washington Ave., St. Louis. 0.
Massey, G. Betton, Sanit., 1823 Wallace St., Philadelphia. 4, 6, 7, 9, 0, 2.
Mathews, Wm. J., 1009 Garden St., Hoboken, N. J. 9, 2.
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Maurer, Edmund L., Brownton, Minn. 3.
Max, C. O. C., 1889 Ry. Exchg. Bldg., St. Louis. 0.
May, Wayne H., 400 Central Ave., Minneapolis, Minn. 3.
Mayes, J. A., 324½ N. Main St., Denison, Tex. 0.
Mayland, M. L., 225½ Central Ave., Faribault, Minn. 8, 3.
Mayne, Wm. H., 608 Wright & Callender Bldg., Los Angeles, Cal. 1.
Meanes, L. L., 302 Securities Bldg., Des Moines, Iowa. 2.
Meek, Edward, Little Rock, Ark. 0.
Meierding, Wm. A., Springfield, Minn. 3.
Mellby, O. F., Thief River Falls, Minn. 3.
Melvin, J. Tracy, Porterville, Cal. 1.
Mensel, Harry H., 65 Main St., Oshkosh, Wis. 3.
Messinger, M. P., Oakfield, N. Y. 3.
Meyers, Elmer L., 17 W. South St., Wilkes-Barre, Pa. 2.
Michaux, Stuart, 323 E. Franklin St., Richmond, Va. 2.
Miles, Clarence C., Greenport, N. Y. 9.
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Miller, C. K., 600 Atlantic Ave., Brooklyn, N. Y. 2.
Miller, G. Brown, 1730 K. St. N.W., Washington, D. C. 9.
Miller, Harold A., 617 Pittsburgh Life Bldg., Pittsburgh, Pa. 9, 2.
Miller, Mary T., 313 N. 33d St., Philadelphia. 2.
Miller, S. M., Box 544, Knoxville, Tenn. 9, 1.
Miller, V. A., Lake Arthur, La. 8, 3.
Miller, W. E., Columbus, Ill. 8, 1.
Mills, Henry M., 192A 6th Ave., Brooklyn. 6, 7, 9, 2.
Miner, Elizabeth R., Macomb, Ill. 0.
Missimore, L. E., 4869 Page Blvd., St. Louis. 0.
Mitchell, John H., Mt. Vernon, Ill. 0.
Mitchell, Ralph S., Grand Meadow, Minn. 3.
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Moore, Will H., Sykeston, N. D. 3.
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Nichols, F. C., 220, 3rd St., Wausau, Wis. 3.
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Nye, H. W., Osborne, Kan. 3.

Offutt, Lemuel, Greensburg, Pa. 9.
Ogden, R. H., 546 Holly Ave., St. Paul, Minn. 3.
Oliver, A. H., 121 Vandalia St., Edwardsville, Ill. 0.
Olsen, S. H., Milaca, Minn. 0.
Oppegaard, M. O., New London, Minn. 3.
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Overton, John, Douglas Infirmary, Nashville, Tenn. 3.
Oyler, H. S., Lincoln, Ill. 0.

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Parman, David R., 4503 Page Blvd., St. Louis. 0.
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Pollock, A. R., Monte Vista, Colo. 3.
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Potter, Marion Craig, 1487 South Ave., Rochester, N. Y. 9, 2.
Potts, F. T., Toluca, Ill. 0.
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Richards, Raymond G., St. David, Ill. 3.
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Schweikart, Fredk. J., 26 Victor Pl., Elmhurst, N. Y. 9.
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Seippel, Clara P., 2300 Michigan Ave., Chicago. 3.
Seiss, F. H., Taneytown, Md. 9.
Seymour, F. E., Fort Dodge, Ia. 3.
Sexton, J. C., Rushville, Ind. 1.
Shafer, H. O., 1200 N. Dearborn St., Chicago. 0, 3.
Shafer, Winfield S., Rochester, Ind. 0.
Sherrick, C., Monmouth, Ill. 3.
Sherwood, H. H., Humboldt, S. D. 3.
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Shulean, N. S., Cambridge, Minn. 3.
Sigmond, Harvey W., Crawfordsville, Ind. 0.
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Sledge, W. H., 113 St. Joseph St., Mobile, Ala. 9.
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Smith, Cassar, 903 W. State St., Olean, N. Y. 9.
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Smith, H. W., Roodhouse, Ill. 0.
Smith, J. C., 145 Brackenridge Ave., Tarentum, Pa. 2.
Smith, J. C., Thompson, N. D. 3.
Smith, L. S., Monough, W. Va. 0.
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Spalding, Alfred Baker, Lane Hosp., San Francisco. 3.
Spears, Claude G., Live Oak, Altus, Okla. 3.
Spiller, Wm. H., 307 Second Ave., New York City. 9, 1, 2.
Sprecher, S., Tripp, S. D. 3.
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Stein, Newton H., Middleport, Pa. 9.
Steiner, D. W., 123 N. Elizabeth St., Lima, Ohio. 8, 3.
Stelle, H. L., Pittsburg, Kan. 1.
Stewart, Otto K., Canisteo, N. Y. 9.
Stewart, Zella W., Iowa City, Iowa. 9.
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Storrs, Henry John, 4518 Washington Ave., St. Louis. 0.
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Strasser, August A., Arlington, N. J. 7, 9.
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Ulrich, Mabel S., 420 Syndicate Bldg., Minneapolis, Minn. 3.
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Wallace, G. R., Bertrand, Mo. 0.
Walton, John E., Medora, Ill. 0.
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Ward, G. G., Jr., 71 W. 50th St., New York City. 4, 6, 7, 9.
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Weber, Geo. T., Olney, Ill. 9, 2.
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White, Allan S., Rice Lake, Wis. 3.
White, Benjamin W., 477 State St., Bridgeport, Conn. 9.
White, Geo. R., 4 East Liberty St., Savannah, Ga. 9.
White, Marion L., Dixon, Ill. 0.
Whitehead, H. E., 5 Washington St., Mt. Holly, N. J. 2.
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Wickstrom, Emma M., 443 W. Division St., Chicago. 0.
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Willeford, G. W., Washington, Ind. 8, 0.
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Wilson, Jefferson H., Beaver, Pa. 9.
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Wilson, W. F., Lake City, Minn. 3.
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Woodul, T. W., 2d and Pine Sts., Pine Bluff, Ark. 0.
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Yost, Walter B., 1115 Union Ave., St. Louis. 0.
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Zimmermann, Ernst F., 632½ Main St., Quincy, Ill. 8, 0.
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